Dissertation

"A SCORE TO DECIDE THE MANAGEMENT OF BLUNT INJURY ABDOMEN"

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CERTIFICATE

This is to certify that, the dissertation entitled **"A SCORE TO DECIDE THE MANAGEMENT OF BLUNT INJURY ABDOMEN"** is the bonafide work done by **Dr.KRISHNA MOHAN.B** during his MS (General Surgery) course 2013-2016, done under my supervision and is submitted in partial fulfilment of the requirement for the M.S.(BRANCH-I)- General Surgery of The Tamilnadu Dr.MGR Medical University, April 2016 examination.

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DECLARATION

I, certainly declare that this dissertation titled "A SCORE TO DECIDE THE MANAGEMENT OF BLUNT INJURY ABDOMEN" represents a genuine work of mine. The contributions of any supervisors to the research are consistent with normal supervisory practice, and are acknowledged.

I also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other University board, either in India or abroad. This is submitted to The Tamil Nadu Dr. M.G.R Medical University, Chennai in partial fulfilment of the rules and regulations for the award of Master of Surgery Degree Branch I (General Surgery).

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As I walk down the memory lane I realize with a deep sense of humility that what I have done now would not have materialised, but for certain luminaries, who have enlightened my path to wisdom.

"Surgery is learnt by apprenticeship and not from textbooks, not even from one profusely illustrated" – Ian Aird.

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A SCORE TO DECIDE THE MANAGEMENT OF BLUNT INJURY ABDOMEN

Dr.Krishna Mohan.B

Aims and Objectives: A score based on clinical findings and investigations, to diagnose intra-abdominal injury and decide on the management of blunt injury abdomen. This study is designed to provide a new score for better diagnosis of intra-abdominal injury and help to decide on the management of blunt injury abdomen.

Methods: This prospective observational study was conducted in institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, from February 2015 to August 2015. The study was conducted on 100 randomly selected patients with blunt injury abdomen and satisfying the inclusion criteria. Data was gathered based on patient history, clinical examination, White Blood Cell count, Serum Creatinine, Liver enzymes, chest X-ray, Ultrasound abdomen and Computed tomography abdomen. All the 100 patients were evaluated using the 30-point blunt abdominal injury scoring system based on 10 important parameters. Based upon the above scoring system and outcome the patients were divided into three groups, i.e., low risk, intermediate risk and high risk for intra-abdominal injury. Statistical significance was calculated for each parameter and total score using Chi-square test.

Results: Age of 100 patients ranged from 20 to 72 years. Most of the patients (29%) were between 20-29 years. The male to female ratio was 4.5: 1. So, males were the predominantly involved group. The most common mode of injury was Road traffic accident (RTA) which accounted for 67% of blunt injury abdomen.. Based upon the above scoring system and outcome the patients were divided into three groups, i.e., low risk, intermediate risk and high risk. Scores of 14 and 18 were considered the cut-off points. Patient with a score less than 14

were identified as low risk for intra-abdominal injury (IAI). Scores of greater than/equal to 18 were identified as high risk for IAI. Scores between 14 and18 were identified as intermediate risk for intra-abdominal injury. Predominantly most blunt injury abdomen patients in the study were identified as low risk for intra-abdominal injury (57%). Out of the 100 patients with blunt injury abdomen in our study, only thirteen (13%) patients had Intra-abdominal injury. Patients in the age group of 30-39 years with blunt injury abdomen were found to be more at risk for Intra-abdominal injury. Males are more at risk compared to females. Out of the 10 parameters in the scoring system, except for abdominal pain all other parameters were statistically significant. 76 patients were discharged after initial evaluation without admission, out of the 76 patients, 57(75%) patients were identified as low risk for intra-abdominal injury and had scores <14 and; 19(25%) patients were identified as intermediate risk for intra-abdominal injury and had scores between 14 to 18. 20 patients required admission and observation and all of them were identified as intermediate risk for intra-abdominal injury and had scores between 14 to 18. 4 patients required laparotomy and all of them were identified as high risk for intra-abdominal injury and had scores ≥18. According to Chi Square test, there is a definite statistical correlation between the score and risk of intra-abdominal injury, outcome & management of blunt injury abdomen.

Conclusion: Scores <14 are considered low risk for intra-abdominal injury and can be discharged after initial evaluation, Scores between 14-18 are considered intermediate risk for intra-abdominal injury and need admission and observation, Scores ≥ 18 are considered high risk for intra-abdominal injury and need laparotomy. Hence using this score we can detect intra-abdominal injury with reasonable accuracy and decide on the management of blunt injury abdomen, which will reduce the mortality and morbidity in patients with blunt injury abdomen.

CONTENTS

INTRODUCTION

Blunt abdominal trauma is regularly encountered in the emergency department. The lack of historical data and the presence of distracting injuries or altered mental status, from head injury or intoxication, can make these injuries difficult to diagnose and manage. Patients are frequently kept for observation following blunt abdominal trauma, despite initially negative evaluations.

Victims of blunt abdominal trauma often have both intra- abdominal and extra-abdominal injuries further complicating care. Blunt abdominal trauma accounts for the majority (80%) of abdominal injuries seen in emergency department, and is responsible for substantial morbidity and mortality. The majority of cases are related to road traffic accidents (75%), blows to abdomen (15%) and falls (6-9%).

The prevalence of intra-abdominal injuries among patients presenting to emergency department with blunt injury abdomen is approximately 13-15% .The spleen and liver are the most commonly injured solid organs. Injuries to bowel, mesentery , bladder , pancreas and diaphragm, as well as retroperitoneal structures (kidneys, abdominal aorta, etc.,) are less common but must also be considered .

In this study a conscious attempt is made to develop a score by correlating clinical findings and investigations to diagnose intra-abdominal injuries and decide on management of blunt injury abdomen.

AIM AND OBJECTIVES

Trauma is one of the leading causes of death in patients in our country next only to cardiovascular events, cancer, communicable and non-communicable disease. Among trauma patients blunt injury abdomen comprises approximately 13 – 15% of cases.

With the current use of screening technology such as laboratory evaluations, ultrasound and computed tomography (CT), it is unclear and there is always a debate about which patients require conservative management and laparotomy. So the aim of this study is to develop a score to decide the management of blunt injury abdomen.

Objectives of this study is

1. To analyse patients based on clinical findings
2. To evaluate the patients based on investigations like White Blood Cell count, Serum Creatinine, Liver enzymes(AST/ALT), chest X-ray ,Ultrasound abdomen and Computed tomography abdomen
3. Based on the above data to design a score , to decide the management of blunt injury abdomen

REVIEW OF LITERATURE

HISTORICAL ASPECTS:

Blunt injury as cause of intra- abdominal injuries have been recognized since ancient times. Hippocrates and Galen are said to have correctly described blunt injury abdomen(1). Aristotle was the first to record and describe visceral injuries from blunt injury abdomen. By 15th century distinct triage and surgical protocol had been developed in Babylonia(1). In 1580 AD Ambriose Pare made a reference and description of traumatic herniation of stomach through diaphragm(3)

The first operative repair of traumatic gastric injury was reported by Nollesan in the 18th century(20). The ancient Chinese used a high velocity blow to the region of spleen as a method of assassination. Trausse in 1827 AD presented a case report of fracture of body of pancreas after blunt trauma(1). Von Recking Hausen described a case report of arterial thrombosis occurring as a result of blunt injury abdomen. Prior to 19th century, the mortality resulting from intra-abdominal injuries was nearly 100%(2). In 1906 AD Solomon performed peritoneal lavage for the first time. Barily reported 32 cases of ruptured spleen during the period 1894-1924 AD(2). In 1934 AD Aenhium used puncture of abdominal wall as a diagnostic procedure in abdominal injuries(2). In 1938 AD Branch reported 2 cases of liver laceration treated by resection of left lobe(2).

The development of emergency medical service is an important milestone in the history of clinical and surgical practice of trauma (1). Greek physicians were present during wars and battles, and Romans built hospitals close to battlefields. Cincinnatti General Hospital first instituted the ambulance system in 1865(1).

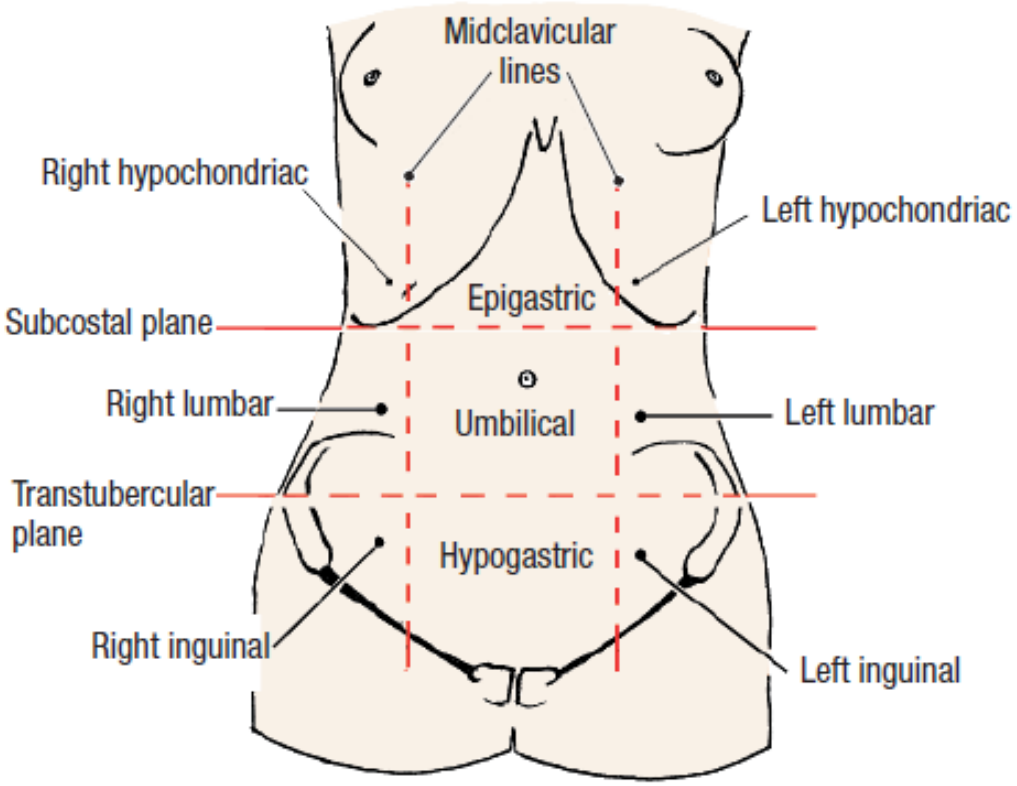
Present day management of trauma, especially blunt abdominal trauma has improved by leaps and bounds(5). Improved first aid measures , swift triage ,advanced laboratory investigations and advanced imaging techniques like spiral Computed tomography(CT) scan and Magnetic Resonance Imaging have facilitated early detection of intra-abdominal injuries and paved way for earlier and accurate decisions regarding management of blunt injury abdomen , and thereby reducing both morbidity and mortality(6).

ANATOMY OF ABDOMEN:

The Abdomen is the region of the trunk that lies between the diaphragm above & the inlet of the pelvis below. Superiorly, the abdominal wall is formed by the diaphragm, which separates the abdominal cavity from the thoracic cavity .Inferiorly the abdominal cavity is continuous with the pelvic cavity through the pelvic inlet. Anteriorly, the abdominal wall is formed by the lower part of thoracic cage & below by the rectus abdominus muscle, external oblique muscle, internal oblique muscle & transverse abdominus muscle & fasciae. Posteriorly, the abdominal wall is formed in the midline by the vertebrae & their intervertebral discs, upper part of bony pelvis, the psoas muscle, the quadratus lumborum muscle, and the aponeurosis of origin of transversus abdominus muscle(2).

The abdomen is divided into nine regions for descriptive purpose by two horizontal lines and two vertical arbitrary lines. The horizontal lines are the trans-pyloric and, at the level of pylorus of the stomach and passes through the tip of the ninth costal cartilage, and the other horizontal line is the intertubercular line passing between the iliac tubercles. The two vertical lines are from the midclavicle downwards. The resulting regions are right and left hypochondriac, epigastric, right and left lumber, umbilical, right and left iliac , and hypogastric(2).

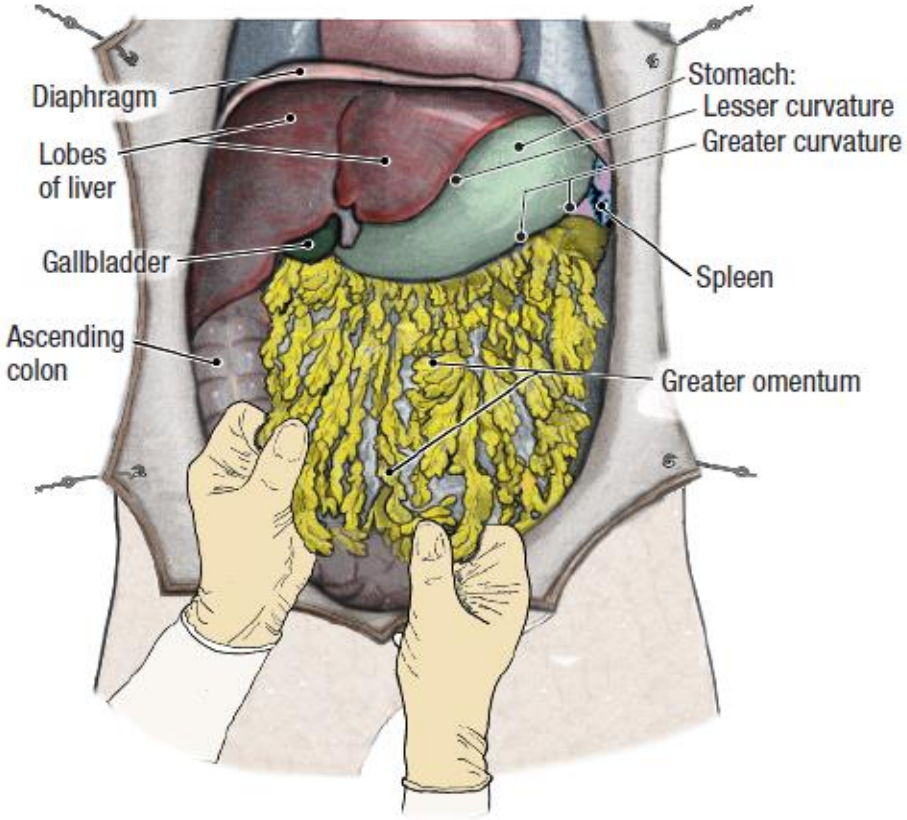
Image I: Regions of abdomen



PERITONEUM AND PERITONEAL CAVITY:

It is a serous membrane lining the wall of the abdomen & the pelvic cavities (parietal peritoneum) & clothing the abdominal & pelvic viscera (visceral peritoneum) , the space between them called the peritoneal cavity which contain small amount of fluid(3)

Image II: Peritoneal cavity and its contents



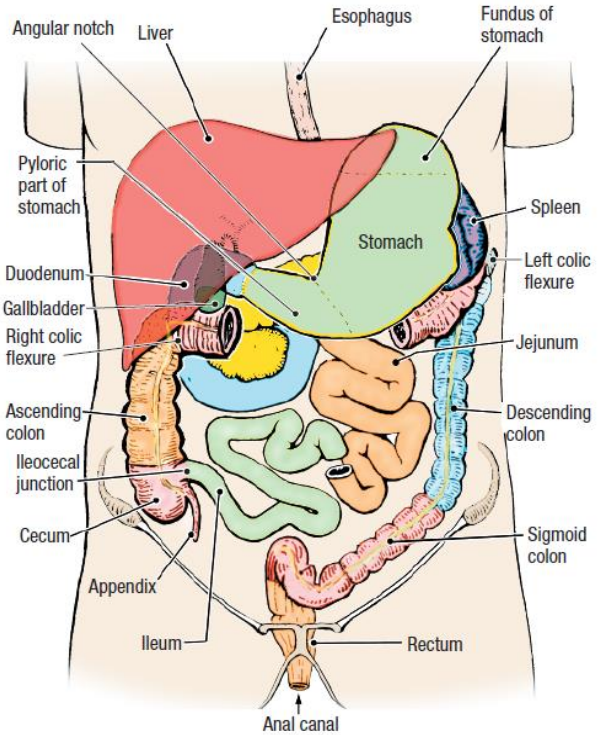
Developmentally abdominal and pelvic viscera invaginate into the abdominal cavity carrying the peritoneum before them. Between the parietal peritoneum & the fascia covering the abdomen is a layer of connective tissue called the extra-peritoneal tissue. The organs which are covered totally with visceral peritoneum are called intraperitoneal organs while those covered partially or lying behind are called retroperitoneal organ. The involution, fusion, shortening of these peritoneal folds during development divides the peritoneal cavity into two distinct spaces, the greater and lesser sac. In males peritoneal cavity is a closed cavity, whereas in females it communicates with exterior through the openings of the fallopian tube at the fimbrial end(3).

GASTROINTESTINAL TRACT:

Stomach: The stomach is a muscular organ located in the intra-thoracic position of the abdomen ,and is well protected from injury by the overlying ribs. It has several attachments by which it is suspended in the abdomen, i.e., superiorly by gastro-hepatic ligament, inferiorly by gastro-colic ligament and by its attachment to the spleen laterally in addition to these attachments it is relatively fixed at the gastro – oesophageal junction and the retro peritoneal duodenum(10) . It communicates with the oesophagus at the cardiac orifice and the first part of duodenum by the pyloric orifice. The anterior surface is related to the diaphragm, left lobe of the liver (9). The posterior surface is related to pancreas, transverse mesocolon and spleen. The stomach is made up of three layers of which the submucosa is the strongest (11). The thickness of the stomach wall is the main factor that contributes to the rarity of blunt gastric rupture (15). The stomach is supplied by four major arteries namely left gastric, right gastric , left gastro – epiploic and right gastro epiploic arteries. As there is extensive collateralization of gastric blood supply, there is no necrosis even if three of the four major vessels are disrupted. So repair of most gastric injuries can be done without the fear of devascularising a portion of a gastric wall (17). On the other hand, gastric injuries can bleed extensively, and care must be taken to secure adequate hemostasis when repairing these wounds(17).

Duodenum: It extends from the pylorus which lies opposite the right side of the spine at the level of the first lumbar vertebra, to the duodeno-jejunal flexure (18). It is roughly C-shaped and is about 25cm long. It is unique due to its deep anatomic location, retroperitoneal fixation, and connection to the biliary tract and secretory ducts of pancreas (22). It receives blood supply from branches from both coeliac and superior mesenteric vessels. Its blood supply is shared with the pancreatic head, which complicates management of both pancreatic and duodenal injuries. It consists of four parts, first part is intra-peritoneal and rest of it is retro-peritoneal. The second and third parts can be mobilised by kocher's manoeuvre. Duodenal injuries are complicated due to the combination of bile and pancreatic juices(22).

Image III: Intra-abdominal Organs



Small intestine: The small intestine measures about six meters and extends form the ligament of Treitz to the caecum(21). The proximal two fifth is jejunum, and the distal three fifth is ileum. The small intestine is suspended in the peritoneal cavity by the fan shaped mesentery which extends from the left side of second lumbar vertebra to the right sacro-iliac joint. The main blood supply is from the superior mesenteric artery. Small bowel injuries are not that uncommon in blunt injury abdomen and traumatic perforations frequently silent and manifest after 24-48 hours of injury(25).

Large intestine: The large intestine measures about 1.5 meters in length and extends form the ileo-caecal junction to the anus. It is divided into caecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum and anal canal. Large intestine is characterised by its longitudinal muscle bands called Taenia Coli and the appendices epiploicae(20).

Gall bladder: It is located in the inferior surface of right lobe of liver. It is pyriform shaped organ , and its main function is reservoir and concentration of bile. It consists of three parts, i.e. fundus, neck and body. It drains through the cystic duct into the Common bile duct. Its blood supply is from the cystic artery, a branch of the right hepatic artery(24).

Urinary bladder: It is a muscular organ, lined by transitional epithelium and located in the anterior part of the pelvic cavity. An empty bladder is tetrahedral

in shape (full bladder is ovoid in shape), and has an apex directed forwards, a base directed downwards and a neck which is the lowest and most fixed part of the bladder. Superiorly only the anterior portion is covered by peritoneum, and the rest it is extra-peritoneal(6). So after blunt injury abdomen rupture of bladder can be both intra or extra-peritoneal. The suprapubic portion of the bladder varies with the degree of distention. Distended bladders are more susceptible for injuries. Blood supply is mainly from superior and inferior vesical arteries, branches of internal iliac arteries(5).

Retroperitoneal structures: Retroperitoneal structures are less commonly involved in blunt injury abdomen. The retroperitoneal structures commonly involved are the Kidneys, pancreas, second part of duodenum, and rarely great vessels, ureters and iliac blood vessels. Isolated retroperitoneal hematomas without significant organ damage can occur, but always try to rule out injury to retroperitoneal structures in the presence of significant/expanding retroperitoneal hematoma(5).

Liver: The liver is one of the most frequently injured organs in abdominal trauma. The anterior location in the abdominal cavity and fragile parenchyma with easily disrupted Glisson's capsule make this organ vulnerable to injury. Recent advancements in imaging studies and enhanced critical care monitoring strategies have shifted the paradigm for the management of liver injuries. Non-operative management of both low- and high-grade injuries can be successful in

hemodynamically stable patients. Direct suture ligation of bleeding parenchymal vessels, total vascular isolation with repair of venous injuries, and the advent of damage control surgery have all improved outcomes in the hemodynamically unstable patient population. Anatomical resection of the liver are rarely indicated(9).

Spleen: The spleen is an organ in the left upper quadrant of the abdomen that filters blood by removing old or damaged blood cells and platelets. While not essential to sustain life, the spleen performs protective immunological functions in the body. It also helps the immune system by destroying bacteria and other foreign substances by opsonization and phagocytosis, and by producing antibodies. Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups. These injuries are common in both rural and urban environments and result from motor vehicle crashes, domestic violence, sporting events, and accidents involving bicycle handlebars(4).

PATHOPHYSIOLOGY OF BLUNT INJURY ABDOMEN:

Several pathophysiological processes will take place in a case of blunt abdominal injury. Understanding the mechanism of injury is important in the management of a patient with blunt abdominal trauma; injuries can be classified as high energy or low energy(14).

a) Blunt trauma over the abdomen causes damage from a combination of compression and shearing, bursting forces. Sudden, pronounced increase in intra-abdominal pressure caused by outward forces can cause rupture of the hollow viscera or can cause burst injury of solid organs.

b) Compression of abdominal viscera between applied force to the abdominal wall and the posterior thoracic cage of the vertebral column can produce a severe crush injury.

c) Abrupt shearing forces can cause tear of organs or vascular pedicles.

d) Oblique forces and deceleration injury can cause shearing of viscera where anchored, such as at site of the duodeno-jejunal flexure and peritoneal attachments of the bowel.

e) Deceleration injuries occur in high speed vehicular accidents and also in falls from great heights. On impact, the organs continue to move forward at terminal velocity, tearing the organs at their sites of attachment.

The American Association for the Surgery of Trauma (AAST) liver injury grading system for liver trauma is (15):

- **Grade I**
  - haematoma: subcapsular, <10% surface area
  - laceration: capsular tear, <1 cm depth
- **Grade II**
  - haematoma: subcapsular, 10-50% surface area
  - haematoma: intraparenchymal <10 cm diameter
  - laceration: capsular tear, 1-3 cm depth, <10 cm length
- **Grade III**
  - haematoma: subcapsular, >50% surface area, or ruptured with active bleeding
  - haematoma: intraparenchymal >10 cm diameter
  - laceration: capsular tear, >3 cm depth
- **Grade IV**
  - haematoma: ruptured intraparenchymal with active bleeding
  - laceration: parenchymal disruption involving 25-75% hepatic lobes or involves 1-3 Couinaud segments (within one lobe)

- **Grade V**
  - laceration: parenchymal disruption involving >75% of hepatic lobe or involves >3 Couinaud segments (within one lobe)
  - vascular: juxtahepatic venous injuries (inferior vena cava, major hepatic vein)
- **Grade VI**
  - vascular: hepatic avulsion

The American Association for the Surgery of Trauma (AAST) splenic injury grading system is as follows (15):

- **Grade I**
  - subcapsular haematoma <10% of surface area
  - capsular laceration <1 cm depth
- **Grade II**
  - subcapsular haematoma 10-50% of surface area
  - intraparenchymal haematoma <5 cm in diameter
  - laceration 1-3 cm depth not involving trabecular vessels
- **Grade III**
  - subcapsular haematoma >50% of surface area or expanding

- intraparenchymal haematoma >5 cm or expanding
- laceration >3 cm depth or involving trabecular vessels
- ruptured subcapsular or parenchymal haematoma

- **Grade IV**
  - laceration involving segmental or hilar vessels with major devascularisation (>25% of spleen)
- **Grade V**
  - shattered spleen
  - hilar vascular injury with devascularised spleen

Introduction of assessment scores in trauma:

The assessment of the potential risks of blunt injury abdomen, and its mortality and morbidity is increasingly important for the provision of health care. There is a growing realization that healthcare providers need to ensure appropriate knowledge and utilisation of all the available resources. By doing so, it would enable the most deserving patients to get most appropriate healthcare available in the hospital (3).

Adequate stratification and scoring of risk should, therefore, be considered essential to aid clinical practice. Assessment of patients for categorization may occur at various points throughout the patient's journey

through the hospital, i.e., from the OPD to WARD to OT to ICU. It can be grouped into three stages relating to the operation(1).

1. **Pre-operative assessment:** this is when planning and intervention can help quantify the potential risks of a procedure for the patient by virtue of patient's inbuilt physiological and acquired pathological comorbidities"
2. **Peri-operative assessment** may determine the most suitable setting for further care of the patient i.e., admission into ICU, ward or day care surgical setup. This is based on the preliminary preoperative risk stratification conducted as the patient arrives to the hospital
3. **Post-operative assessment** calculated from the patients Intraoperative variables and the responses to these variations may alter the further management of postoperative patients(2) .

The importance of score/scoring systems in blunt trauma abdomen is that they provide simple, fairly accurate and quicker way of diagnosing intra-abdominal injury, predicting morbidity and mortality, and deciding on the management. Blunt trauma with intra-abdominal injuries is often complex, more complicated with extra-abdominal injuries, and scoring systems aid in predicting and deciding on management of intra-abdominal injuries in blunt injury abdomen(3).

Two studies conducted in India by Nabachandra et al (n=125) and Mousami Singh et al (n=55) revealed that men were the predominant victims of blunt injury abdomen, by ratio of 3.8:1 and 4:1 respectively. The above two studies also revealed that Road traffic accidents are the most common cause of blunt injury abdomen, 86.40% and 70% respectively (3,4). Whereas study conducted by Shojaee M et al (n=261) in China revealed a similar scenario, males were the predominant victims, by a ratio of 4.2:1(80.1%) and most of blunt injury abdomen was due to Road traffic accidents(2).

Several studies on blunt injury abdomen have shown that the prevalence of intra-abdominal injuries in blunt injury abdomen is fairly less, study by John L Kendall et al (n=1169) revealed that intra-abdominal injuries comprise only 7% of all blunt injury abdomen, Whereas study conducted by Shojaee M et al (n=261) suggested that intra-abdominal injuries comprised 18.4% of blunt injury abdomen cases (1,2).

Among intra-abdominal injuries Liver and spleen are the most common. Mousami Singh et al (n=55) reported that the incidence of the involvement of liver, spleen, small intestine, kidney, stomach and urinary bladder were 67%, 30.91%, 18%, 10.9%, 9.09%, 5% cases respectively(4).

Nabachandra et al (n=125) reported that the commonest cause of death was haemorrhagic shock combined with head injury in 48.80% cases followed by haemorrhagic shock alone in 44% of the cases. Peritonitis was the cause of

death in 1.60% cases(3).

A study conducted by Oliver Karam et al in University of Geneva Children's Hospital in 147 consecutive patients admitted for Blunt abdominal trauma in a tertiary care hospital, over a 30-month period. Statistical significance of various parameters (trauma mechanism, clinical examination, laboratory tests, and ultrasound findings) was analysed in relation to intra-abdominal injuries. The 10 parameters with the best negative predictive values (NPV) were then used to build a score. The following points were attributed for these items: abnormal abdominal Doppler ultrasound (4 points), abdominal pain (2 points), peritoneal irritation (2 points), hemodynamic instability (2 points), aspartate aminotransferase >60 IU/L (2 points), alanine aminotransferase >25 IU/L (2 points), white blood cell count >9.5 g/L (1 point), LDH >330 IU/L (1 point), lipase >30 IU/L (1 point), and creatinine >50 μg/L (1 point). A score of ≤7 has a NPV of 97% and includes 67% of the studied population. The study concluded that in hemodynamically stable patients with a normal abdominal Doppler ultrasound and a score (BATiC) of ≤7, intra-abdominal lesions are very unlikely, and systematic Computed tomography (CT) scan or hospital admission may be avoided(5).

A prospective observational study done by Shojaee M et al from April 2011 to October 2012 on patients aged above 18 years and suspected with blunt

abdominal trauma (BAT) admitted to the emergency department (ED) of Imam Hussein Hospital and Shohadaye Hafte Tir Hospital. All patients were assessed and treated based on Advanced Trauma Life Support and ED protocol. Diagnosis was done according to CT scan findings, which was considered as the gold standard. Data were gathered based on patient's history, physical exam, and ultrasound, and CT scan findings by a general practitioner who was not blind to this study. Chi-square test and logistic regression were done. Factors with significant relationship with CT scan were imported in multivariate regression models, where a coefficient (β) was given based on the contribution of each of them. Scoring system was developed based on the obtained total β of each factor. Altogether 261 patients (80.1% male) were enrolled, of which 48 cases had intra-abdominal injury. A 24-point blunt abdominal trauma scoring system (BATSS) was developed. Patients were divided into three groups including low (score<8), moderate (8≤score<12) and high risk (score≥12). In high risk group immediate laparotomy should be done, moderate group needs further assessments, and low risk group should be kept under observation. Low risk patients did not show positive CT-scans (specificity 100%). Conversely, all high risk patients had positive CT-scan findings (sensitivity 100%). The receiver operating characteristic curve indicated a close relationship between the results of CT scan and BATSS (sensitivity=99.3%).The study concluded that the present scoring system furnishes a high precision and reproducible diagnostic

tool for Blunt abdominal trauma detection and has the potential to reduce unnecessary CT scan and cut unnecessary costs(2).

A retrospective cohort study performed by John L Kendall et al at an urban level 1 trauma centre and included all Blunt abdominal injury patients admitted to an emergency department observation unit. All were observed for at least 8 hours as part of the key clinical pathway, and only minors and pregnant women were excluded. Outcomes included the presence of Intra-abdominal injury or death during a 40-month follow-up period. Prior to data collection, low-risk criteria were defined as no intoxication, no hypotension or tachycardia, no abdominal pain or tenderness, no haematuria, and no distracting injury. To be considered low risk, patients needed to meet all low-risk criteria. Of the 1,169 patients included over the 2-year study period, 29% received a computed tomography (CT) of the abdomen and pelvis, 6% were admitted to the hospital from the observation unit for further management, 0.4% (95% confidence interval [CI], 0.1%–1%) were diagnosed with Intra-abdominal injury, and 0% (95% CI, 0%–0.3%) died. Patients had a median combined emergency department(ED) and observation length of stay of 9.5 hours. Of the 237 (20%) patients who met low-risk criteria, 7% had a CT of the abdomen and pelvis and 0% (95% CI, 0%–1.5%) were diagnosed with Intra-abdominal injury or died. Most Blunt abdominal trauma patients who have initially negative emergency department evaluations are at low risk for Intra-abdominal injury but still

require some combination of observation and CT. A subgroup of Blunt abdominal trauma patients may be safely discharged without CT or observation after the initial evaluation(1).

A study conducted by Poletti PA et al on Seven hundred fourteen hemodynamically stable patients with suspicion of blunt abdominal trauma. Admission data for clinical examination, sonography, routine laboratory studies, chest/pelvic radiographic findings, and Glasgow Coma Scale (GCS) score were recorded. Each patient underwent helical abdominal computed tomography(CT). Injuries were considered major if they required surgery or angiographic intervention. At the authors' institution, angiography is routinely performed if there is a splenic injury of American Association for the Surgery of Trauma grade II or higher or a liver injury of American Association for the Surgery of Trauma grade III or higher. Statistical analysis was performed to determine the value of isolated and combined clinical, radiologic, and laboratory parameters in depicting an intra-abdominal injury with regard to CT results and clinical follow-up. The best combination of criteria to identify a major abdominal injury was obtained when sonography, chest radiography, and three laboratory parameters (serum glutamic oxaloacetic transaminase, white blood cell count, and hematocrit) were normal, 22% (129 of 589) of patients without major injuries fulfilled these criteria. The only combination of criteria that completely excluded intra-abdominal injury was obtained when clinical

criteria combined with a Glasgow Coma Scale score > 13, bedside radiologic studies, and laboratory data were all normal, but only 12% (68 of 578) of patients without abdominal injury fulfilled these criteria. The study concluded that after blunt abdominal trauma, admission non-CT criteria can at best identify 12% of patients without intra-abdominal injuries and 22% of patients without major injuries(7).

MATERIALS AND METHODS

The data for this prospective and observational study was obtained from 100 randomly selected patients admitted with blunt injury abdomen in Madras medical college (MMC) and Rajiv Gandhi Government General Hospital (RGGGH). Patients presenting to the trauma ward with blunt injury abdomen during February 2015 to August 2015 at Madras Medical College (MMC) and Rajiv Gandhi Government General Hospital (RGGGH), were counselled for investigations and treatment of blunt injury abdomen.

Inclusion criteria:

- Patients with blunt injury abdomen
- Age more than 18 years and less than 75 years

Exclusion criteria:

- Moribund patients
- Age less than 18 years and more than 75 years
- life threatening injuries other than abdomen injury
- penetrating abdominal trauma
- pregnant women

- patients who did not have reliable history or physical exam (Such as GCS less than 15, alcohol intoxication history taking and physical exam, impaired verbal patients)

All the patients/legal guardians were given an explanation of the study and about the investigative and operative procedures with their merits and demerits, expected results and possible complications. If he/she agrees then the case had been selected for the study. The study did not involve any additional investigation or any significant risk. It did not cause economic burden to the patients. The study was approved by the institutional ethical committee and review board prior to commencement of data collection. Informed consent was taken from each patient/legal guardian. Data were collected by approved data collection form.

Assessment of parameters:

All consenting patients with blunt injury abdomen would be clinically examined after history taking and then subjected to investigations and finally evaluated using the following parameters:

- Abdominal pain
- Pulse rate

- Systolic blood pressure
- Peritonitis
- Free fluid abdomen
- Imaging
- Serum creatinine
- White blood cell count
- Liver enzymes (AST/ALT)
- Other significant injuries

Parameters
Abdominal pain Absent – 1 point Present- 2 points
Pulse rate <90 /min – 1 point 90-110 /min – 2 points >110 /min – 3 points

Systolic blood pressure >120 mmHg – 1 point 90-120 mmHg -2 points <90 mmHg – 3 points
Peritonitis Absent – 1 point Present – 4 points
Free fluid Absent – 1 point Present – 4 points
Imaging Normal – 1 point Free fluid – 2 points Solid organ injury – 3 points
Serum creatinine < 1.4 mg/dl– 1 point >1.4 mg/dl – 3 points

White blood cell count < 10,000 cells/cu.mm – 1 point >10,000 cells/cu.mm – 2 points
Liver enzymes(AST/ALT) Normal – 1 point Elevated – 3 points
Other significant injuries Absent – 1 point Present – 3 points

A brief description of each of the above ten parameters,

1) **Abdominal pain:** Abdominal pain is one of the most important symptom and parameter, indicating intra-abdominal injury. Abdominal pain in different regions of abdomen signifies injury to different set of organs occupying respective regions. In this scoring system presence of abdominal pain is given 2 points and absence is given 1 point.

2) **Pulse rate:** Tachycardia is an important parameter and sign which is manifestation of intra-abdominal injury. Tachycardia in trauma can be misleading; it can be due to other distracting injuries in trauma, or due to

blood loss and hypovolemia. But combined with all other parameters it becomes a significant parameter. Pulse rate above 110/min is given 3 points; 90-110/min is given 2 points and less than 90/min is given 1 point.

3) **Systolic blood pressure:** A fall in systolic pressure in blunt injury abdomen is a key indicator for intra-abdominal injury and hemoperitoneum. Coexisting other system injuries can cause hypotension like head injury, chest injury or pelvic/long bone injuries, vascular injuries. Fall in systolic blood pressure in blunt injury abdomen warrants immediate resuscitation and laparotomy. Systolic blood pressure less than 90mmHg is given 3 points, 90-120mmHg is given 2 points and greater than 120mmHg is given 1 point.

4) **Peritonitis:** Peritonitis is a tell-tale sign of intra-abdominal injury. Guarding, rigidity and rebound tenderness are the clinical signs of peritonitis. Once signs of peritonitis starts setting in blunt abdominal injury patient, it warrants strong suspicion of intra-abdominal injury; close observation and if required laparotomy. Presence of peritonitis is given a 4 points and its absence 1 point.

5) **Free fluid abdomen:** Clinically appreciable free fluid abdomen in a case of blunt injury abdomen is one of the important parameters for identifying intra-abdominal injury. Free fluid abdomen in blunt injury

abdomen signifies hemoperitoneum 50-60%, but can also be due to hollow viscous perforation (10-20%). Liver and splenic injuries are most commonly associated with free fluid abdomen due to hemoperitoneum. Presence of free fluid abdomen is given 4 points and its absence is given 1 point.

6) **Imaging:** Imaging in blunt abdominal trauma is one of the most important parameters in this scoring system. X-rays, Computed tomography(CT) and ultrasound abdomen are the imaging modalities and of them CT abdomen is one of the important investigations in blunt injury abdomen as suggested in study by Shojaee M et al. Presence of solid organ injury is given 3 points , free fluid abdomen is given 2 points and normal study is given 1 point.

Image IV: Ultrasound abdomen(F.A.S.T)

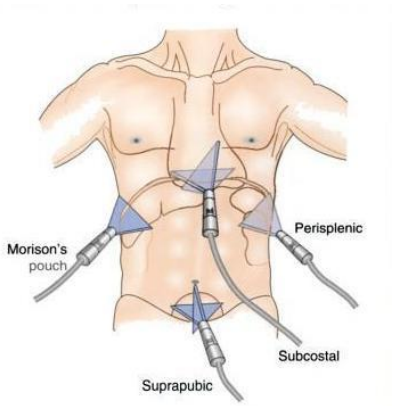
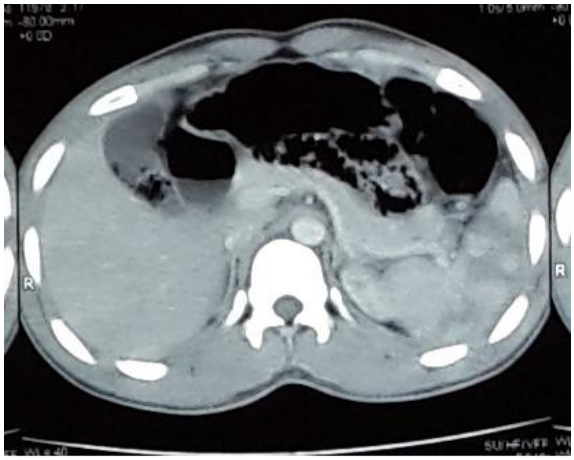


Image V: Computed tomography of abdomen showing splenic injury with hemoperitoneum



7) **Serum creatinine:** Serum creatinine (normal values- 0.6-1.4 mg/dl) can be elevated in cases of renal injuries, ureteric injuries and bladder injuries due to blunt injury abdomen. Serum creatinine can also be elevated due to acute renal failure due to hypovolemia and massive blood loss. Elevated serum creatinine is given 3 points and normal values are given 1 point.

8) **White blood cell count:** Elevated white blood cell (WBC) count is the least specific of all the ten parameters, but combined with other parameters becomes significant in detecting intra-abdominal injury. Elevated WBC count is given 2 points and normal values are given 1 point.

9) **Liver enzymes:** Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are the two important liver enzymes. Since Liver injury is one the common solid organ injuries in blunt injury abdomen, Liver enzymes become important parameters in this scoring system.

Elevated liver enzymes are given 3 points and normal values are given 1 point.

10) **Other significant injuries:** Other significant injuries like chest injury, head injury and orthopaedic injuries often occur with blunt injury abdomen. So it is important to understand which injury needs immediate management. Chest injuries are often associated with liver and splenic injuries (30-40 %). Presence of other significant injuries is given 3 points and absence is given 1 point.

Name, age, sex, I.P.no, date of admission and mode of injury was recorded. The presenting complaints and details were recorded in chronological order

Detailed physical examination including general examination with Glasgow coma scale (GCS), with detailed examination of abdomen and other systems was meticulously done.

On admission of patient with blunt injury abdomen, the first priority was given to resuscitation of patient, followed by consent from the patient/ attenders to take part in study, followed by detailed history taking, physical examination and appropriate investigations (as mentioned above). Patient was evaluated

according to the above mentioned scoring system. Patient was followed up to record the outcome (discharged / observation / laparotomy).

Data analysis was done both manually and using computer. Calculated data was arranged in a systematic manner, presented in various table and figures. All statistical analyses were performed using the SPSS statistical software version 22.

Blunt Injury Abdomen-cases

Image VI:

Image VI: A 40 year old male patient with alleged history of road traffic accident came with blunt injury abdomen, On examination patient had tachycardia, pallor, hypotension, signs of free fluid abdomen and peritonitis, patient was resuscitated and investigated which revealed splenic injury with moderate hemoperitoneum, patient was taken up for emergency laparotomy which revealed hemoperitoneum with splenic injury.Splenectomy was done.According to this study this patient had a score of 23 and high risk for IAI.

Image VII:

Image VII: A 45 year old female patient with alleged history of road traffic accident came with blunt injury abdomen, On examination patient vitals were stable, with no signs of intra-abdominal injury, all ivestigations were normal.According to this study this patient had a score of 14 and low risk for IAI and patient was managed conservatively and discharged.

Intra-abdominal Injury-Splenic Injury

Image VIII:

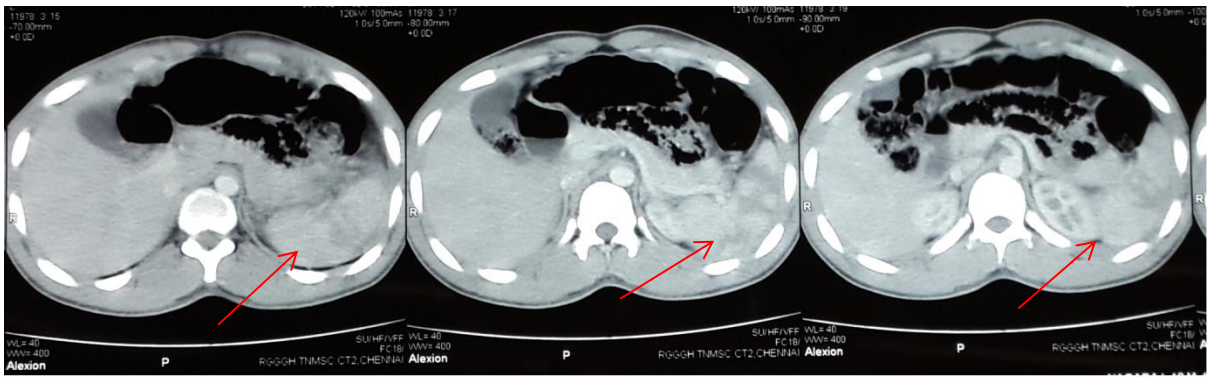


Image IX:

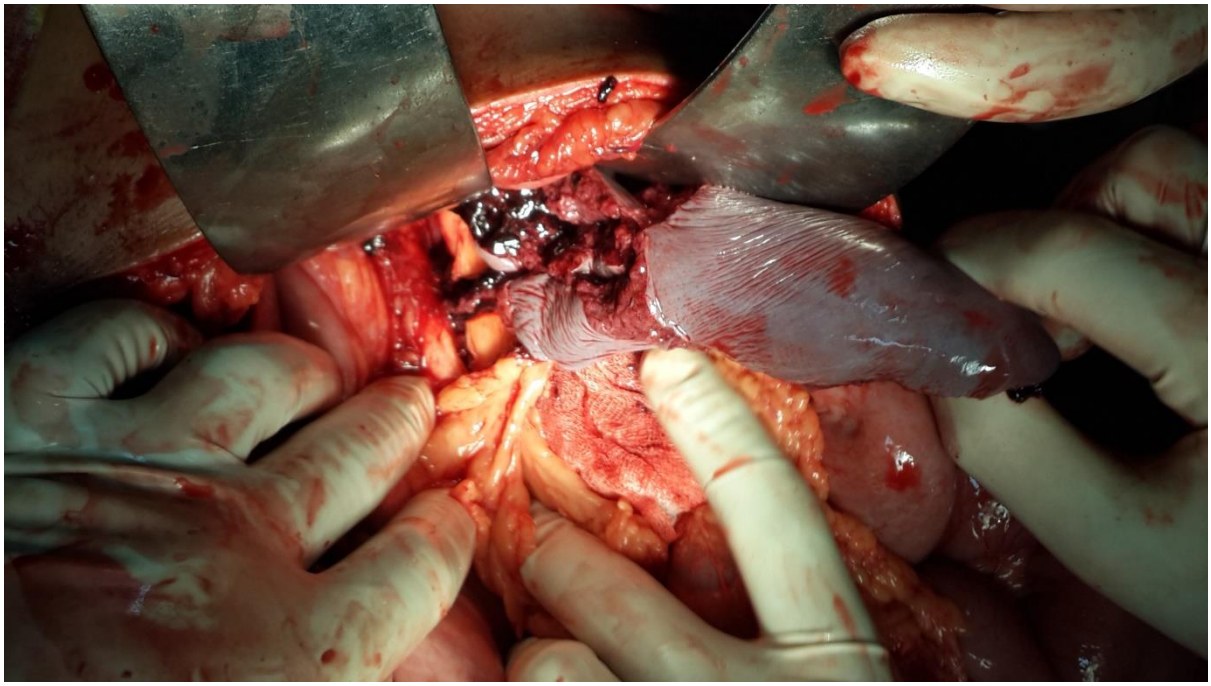


Image X:

Images VIII, IX, X: A 40 year old male patient with alleged history of road traffic accident came with blunt injury abdomen, On examination patient had tachycardia, pallor, hypotension,signs of free fluid abdomen and peritonitis, patient was resuscitated and investigated which revealed splenic injury with moderate hemoperitoneum, patient was taken up for emergency laparotomy which revealed hemoperitoneum with splenic injury. Splenectomy was done.According to this study this patient had a score of 23 and high risk for IAI. Findings are as seen in the above images VIII, IX, X.

Intra-abdominal Injury – Splenic and Renal Injury

Image XI:

Image XII:

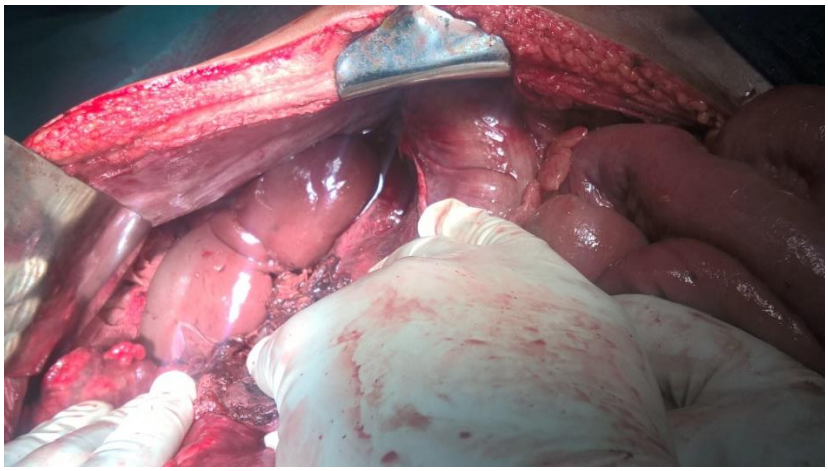


Image XIII:

Images XI, XII, XIII: A 37 year old male patient with alleged history of road traffic accident came with blunt injury abdomen, On examination patient had tachycardia, pallor, hypotension,signs of free fluid abdomen and peritonitis, patient was resuscitated and investigated which revealed splenic injury and renal injury with moderate hemoperitoneum, patient was taken up for emergency laparotomy which revealed hemoperitoneum with splenic injury and renal injury. Splenectomy was done and renal injury was managed conservatively. According to this study this patient had a score of 24 and high risk for IAI. Findings are as seen in the above images XI, XII, XIII.

Intra-abdominal Injury –Bowel and Mesenteric injury

Image XIV:

Image XV:

Image XIV,XV: A 35 year old male patient with alleged history of assault came with blunt injury abdomen, On examination patient had tachycardia, pallor, hypotension,signs of free fluid abdomen, patient was resuscitated and investigated which revealed moderate hemoperitoneum, patient was taken up for emergency laparotomy which revealed hemoperitoneum with traumatic bowel perforation and mesentric tear. Resection and anastomosis of perforated bowel with repair of mesentric tear was done. According to this study this patient had a score of 22 and high risk for IAI. Findings are as seen in the above images XIV,XV.

RESULTS

This prospective and observational study was carried out to devise a score to decide the management of blunt injury abdomen. One hundred patients fulfilling the inclusion criteria form the Surgery department of Madras Medical College and Rajiv Gandhi Government General Hospital during the period of February 2015 to August 2015. The following are the results of the study taking into account the various parameters/factors that decide the management of blunt injury abdomen.

Table 1: Age distribution of patients with blunt injury abdomen

AGE	Number Of Patients
20-29 yrs	29
30-39 yrs	20
40-49 yrs	22
50-59 yrs	15
60-69 yrs	11
70-75 yrs	3
Total	100

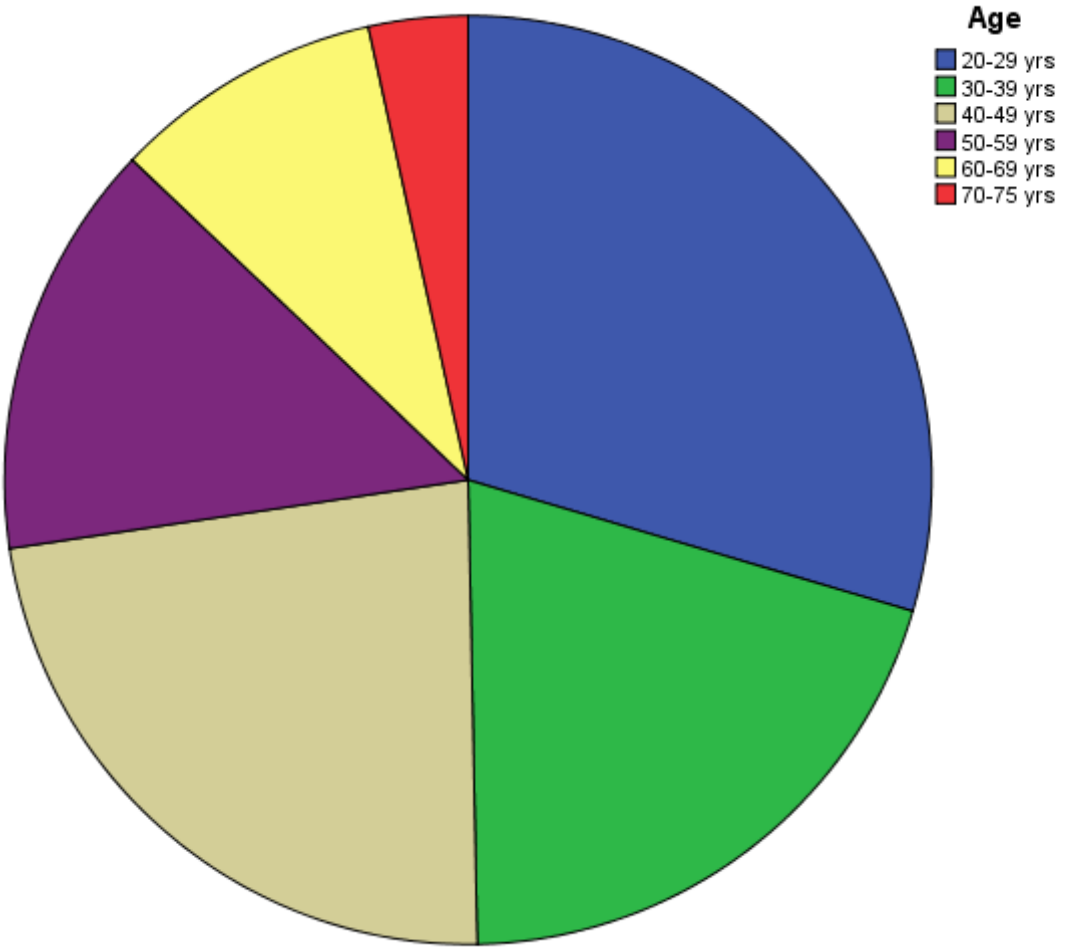


Table 2: Sex distribution of patients with blunt injury abdomen

SEX	NO. OF PATIENTS
MALE	82
FEMALE	18

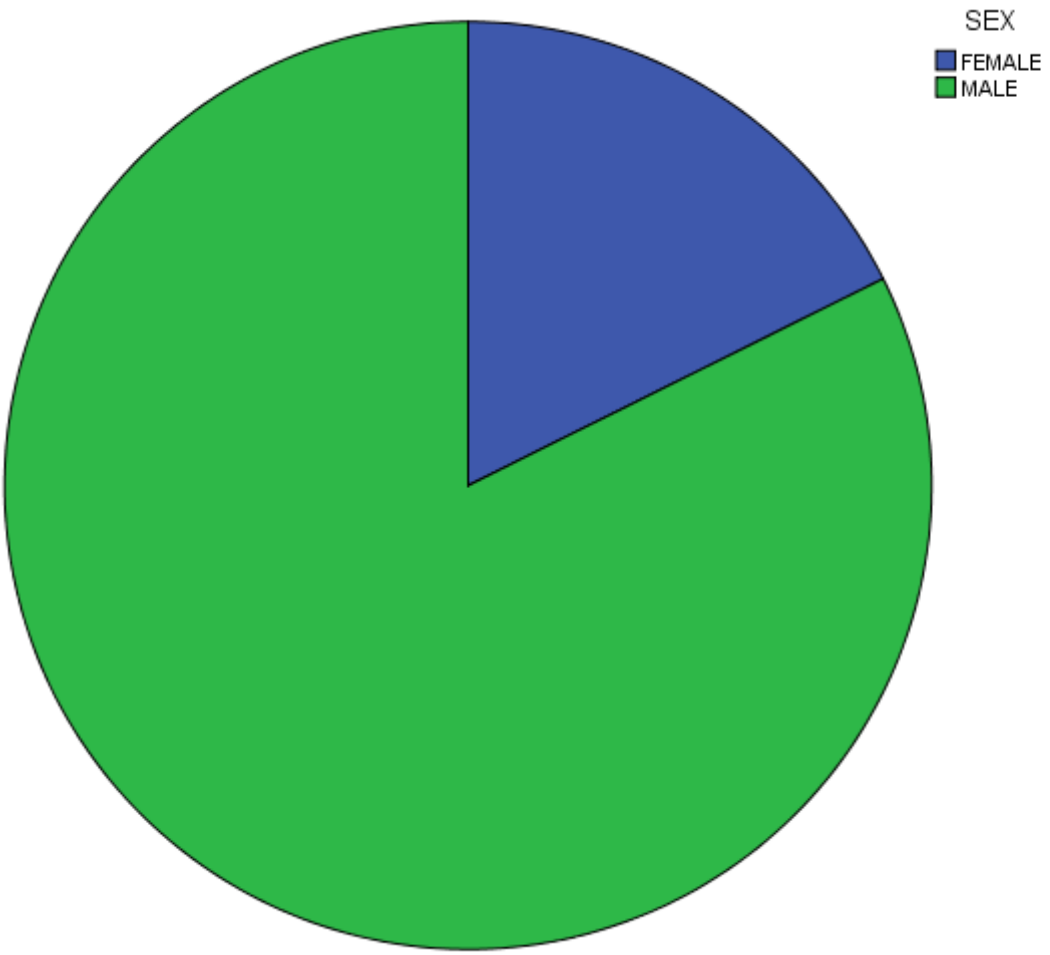


Table 3: Frequency distribution of mode of injury in patients with blunt injury abdomen

MODE OF INJURY	Frequency	Percent	Valid Percent	Cumulative Percent
RTA	67	67.0	67.0	67.0
Fall from height	11	11.0	11.0	78.0
Assault	12	12.0	12.0	90.0
TTA	1	1.0	1.0	91.0
Others	9	9.0	9.0	100.0
Total	100	100.0	100.0	

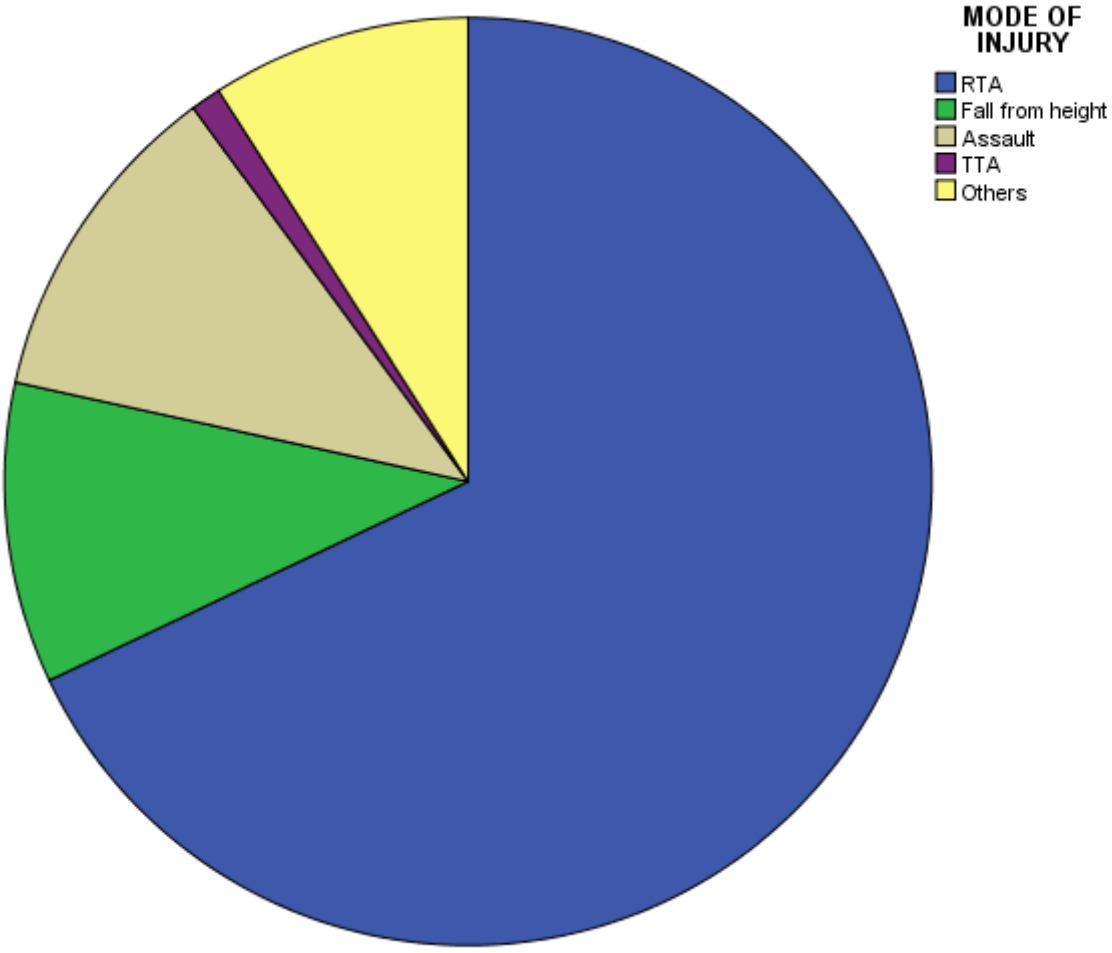


Table 4: prevalence of abdominal pain in patients with blunt injury abdomen

ABDOMINAL PAIN	NO. OF PATIENTS
PRESENT	55
ABSENT	45

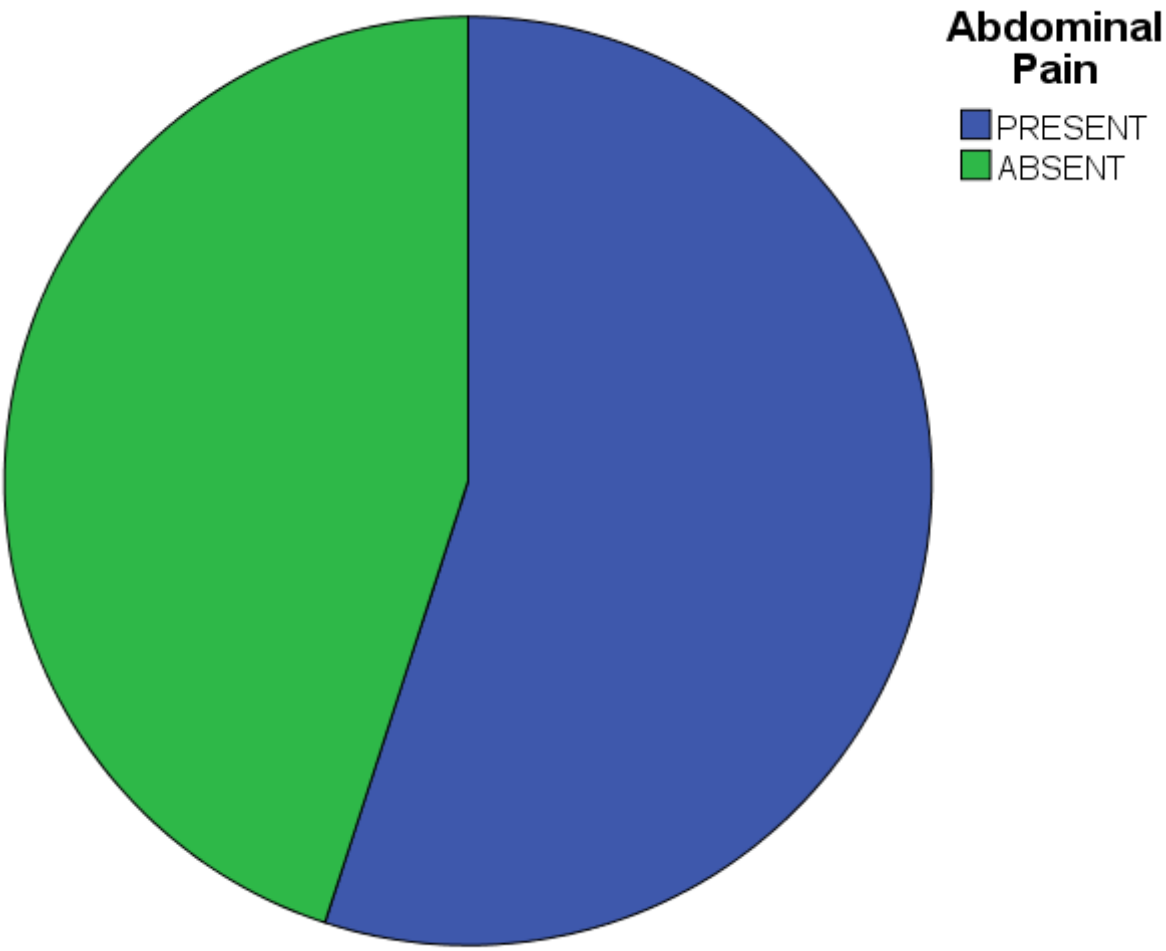


Table 5: Frequency distribution of pulse rate in patients with blunt injury abdomen

PULSE RATE	Frequency	Percent	Valid Percent	Cumulative Percent
<90 /min	56	56.0	56.0	56.0
90-110 /min	26	26.0	26.0	82.0
>110 /min	18	18.0	18.0	100.0
Total	100	100.0	100.0	

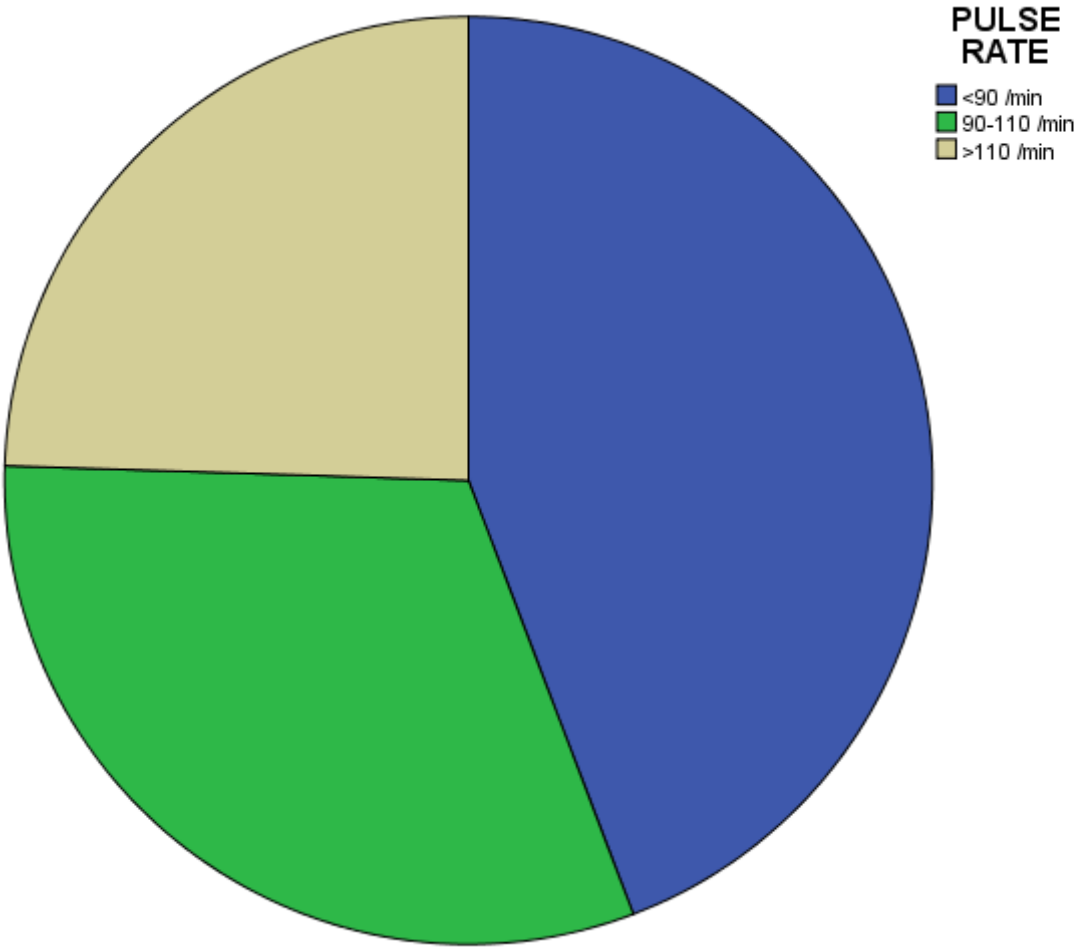


Table 6: Frequency distribution of Systolic blood pressure in patients with blunt injury abdomen

SYSTOLIC BP	Frequency	Percent	Valid Percent	Cumulative Percent
>120 mmHg	55	55.0	55.0	55.0
90-120 mmHg	34	34.0	34.0	89.0
<90 mmHg	11	11.0	11.0	100.0
Total	100	100.0	100.0	

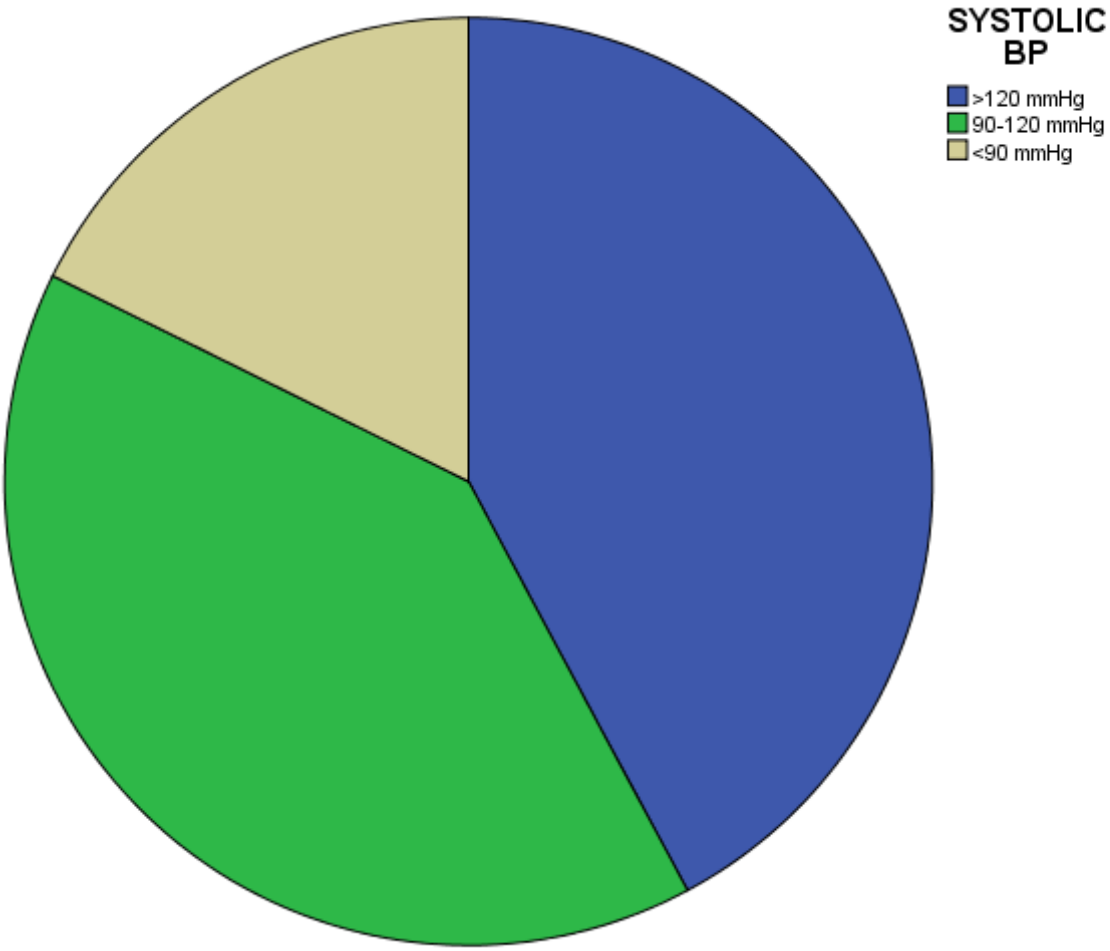


Table 7: prevalence of peritonitis in patients with blunt injury abdomen

PERITONITIS	NO. OF PATIENTS
PRESENT	2
ABSENT	98

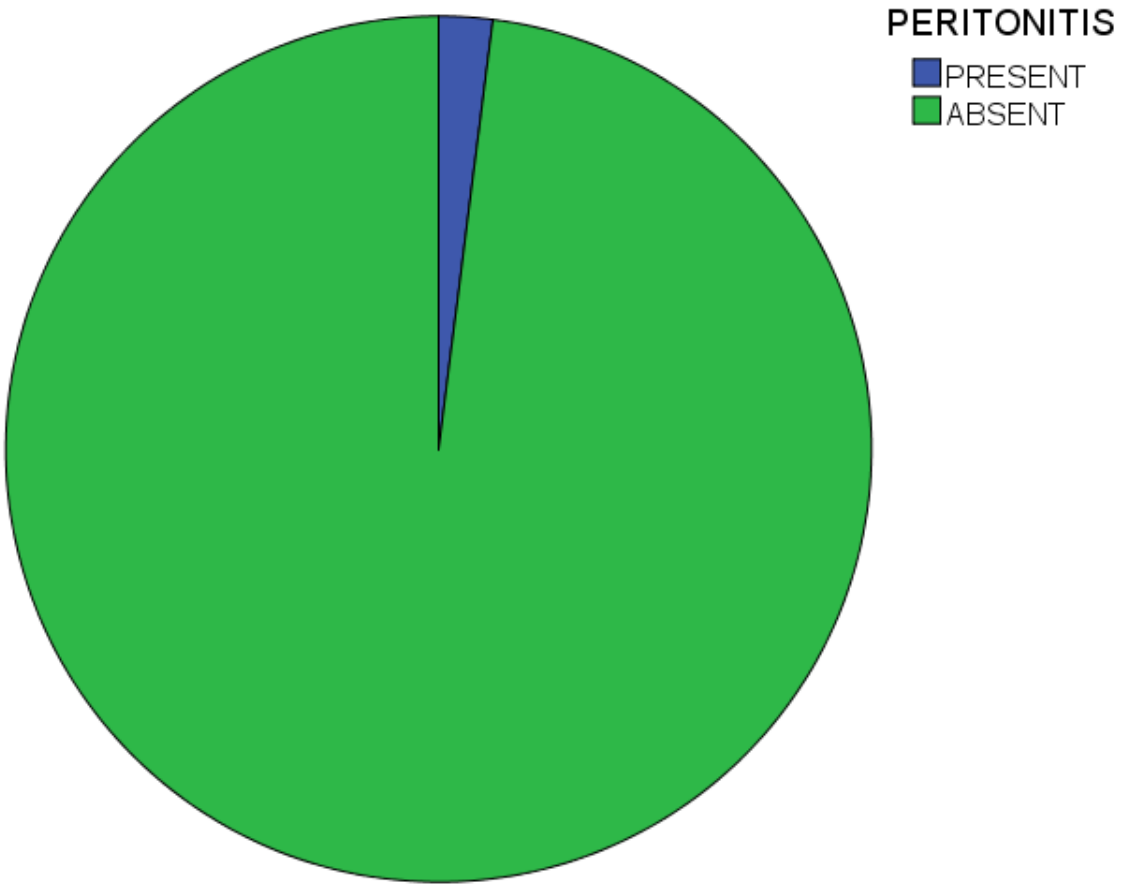


Table 8: prevalence of free fluid in patients with blunt injury abdomen

FREE FLUID	NO. OF PATIENTS
PRESENT	5
ABSENT	95

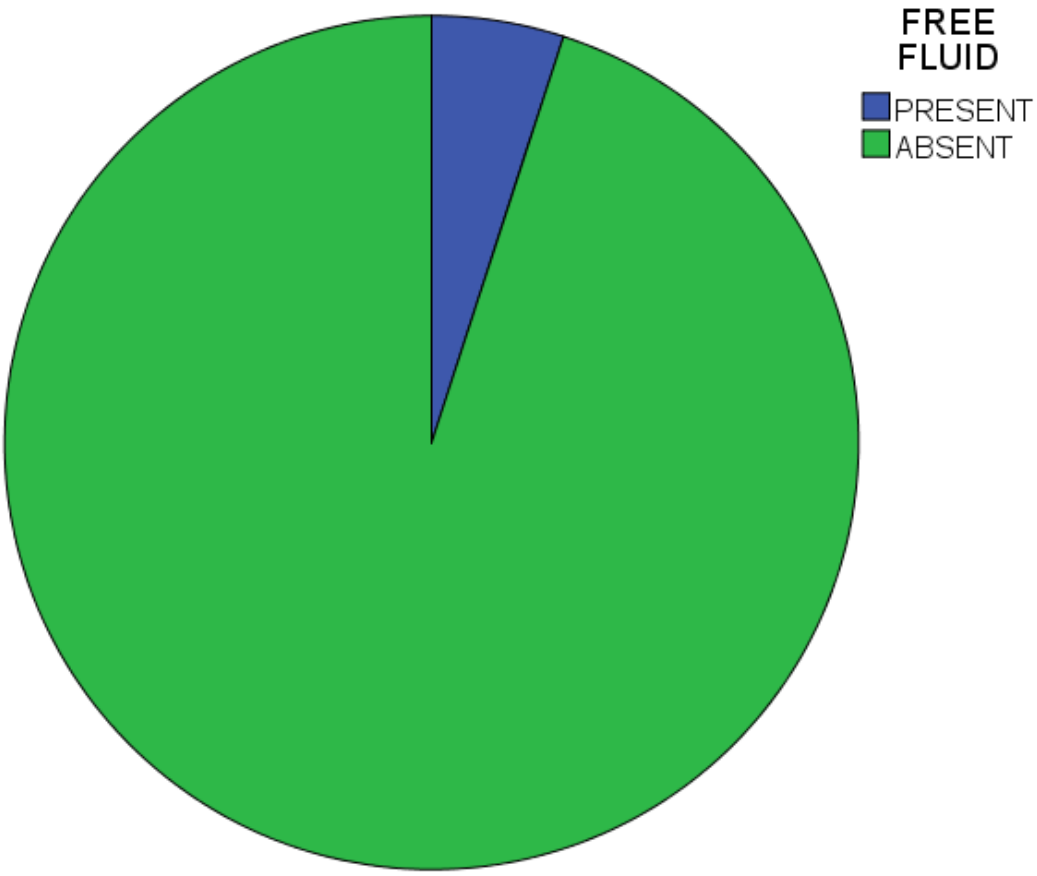


Table 9: Distribution of imaging findings in patients with blunt injury abdomen

IMAGING	NO. OF PATIENTS
NORMAL	87
FREE FLUID	11
SOLID ORGAN INJURY	2

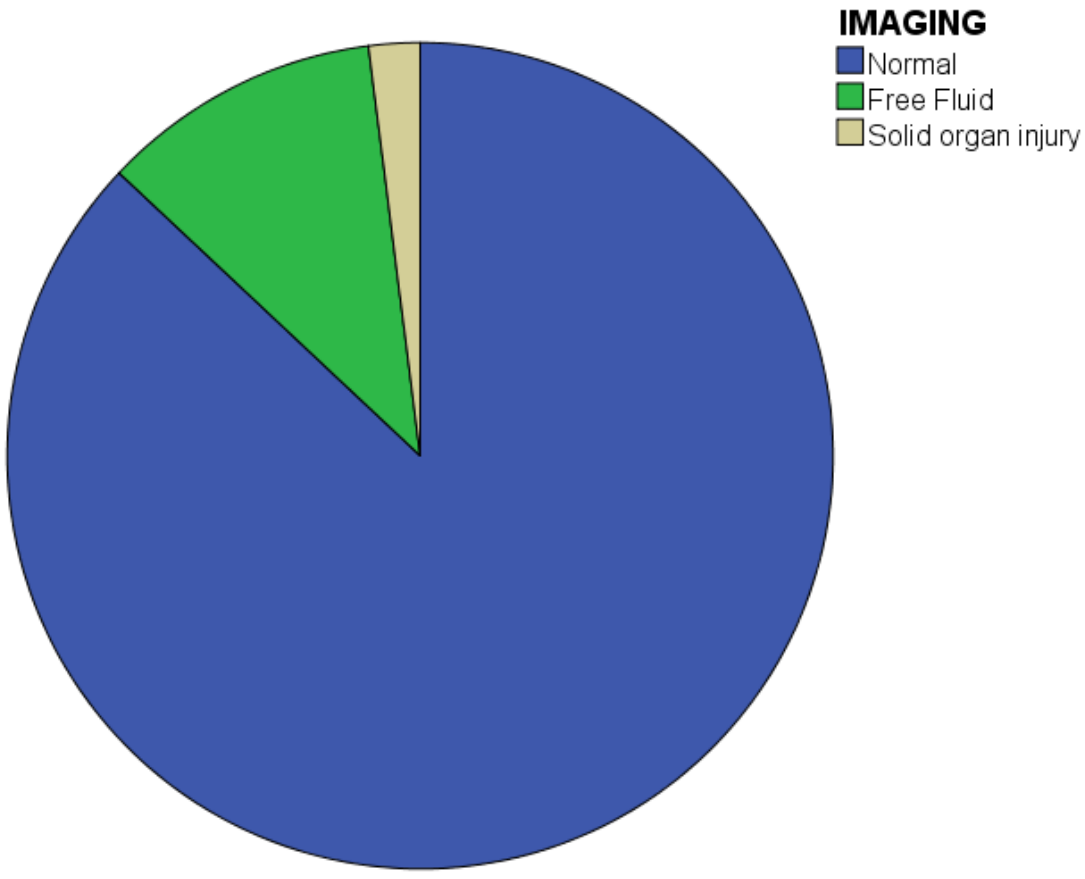


Table 10: Frequency distribution of serum creatinine in patients with blunt injury abdomen

SR.CREAT	Frequency	Percent	Valid Percent
< 1.2 mg/dl	96	96.0	96.0
> 1.2 mg/dl	4	4.0	4.0
Total	100	100.0	100.0

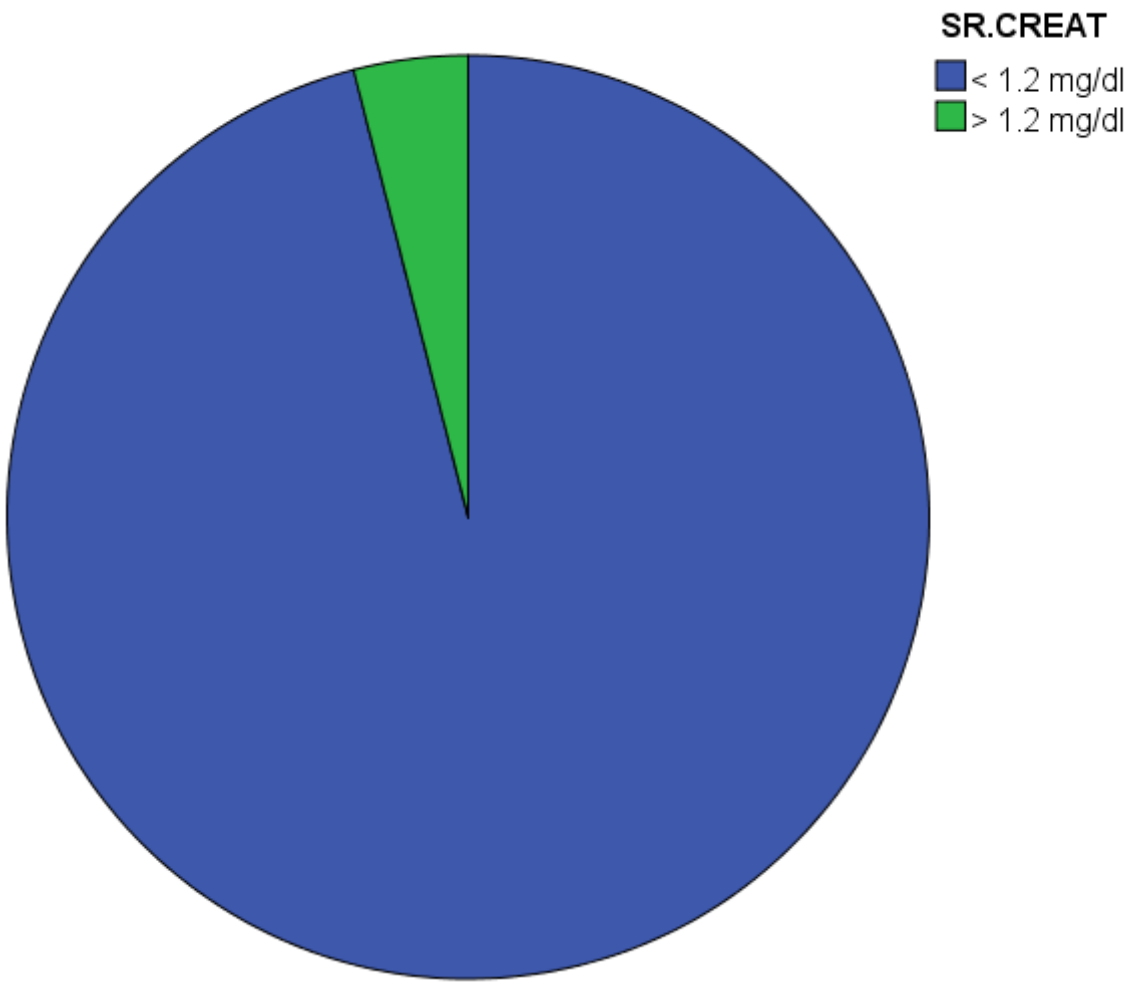


Table 11: Frequency distribution of white blood cell count in patients with blunt injury abdomen

WBC.COUNT	Frequency	Percent	Valid Percent	Cumulative Percent
< 11000 cells/cu.mm	82	82.0	82.0	82.0
> 11000 cells/ cu.mm	18	18.0	18.0	100.0
Total	100	100.0	100.0	

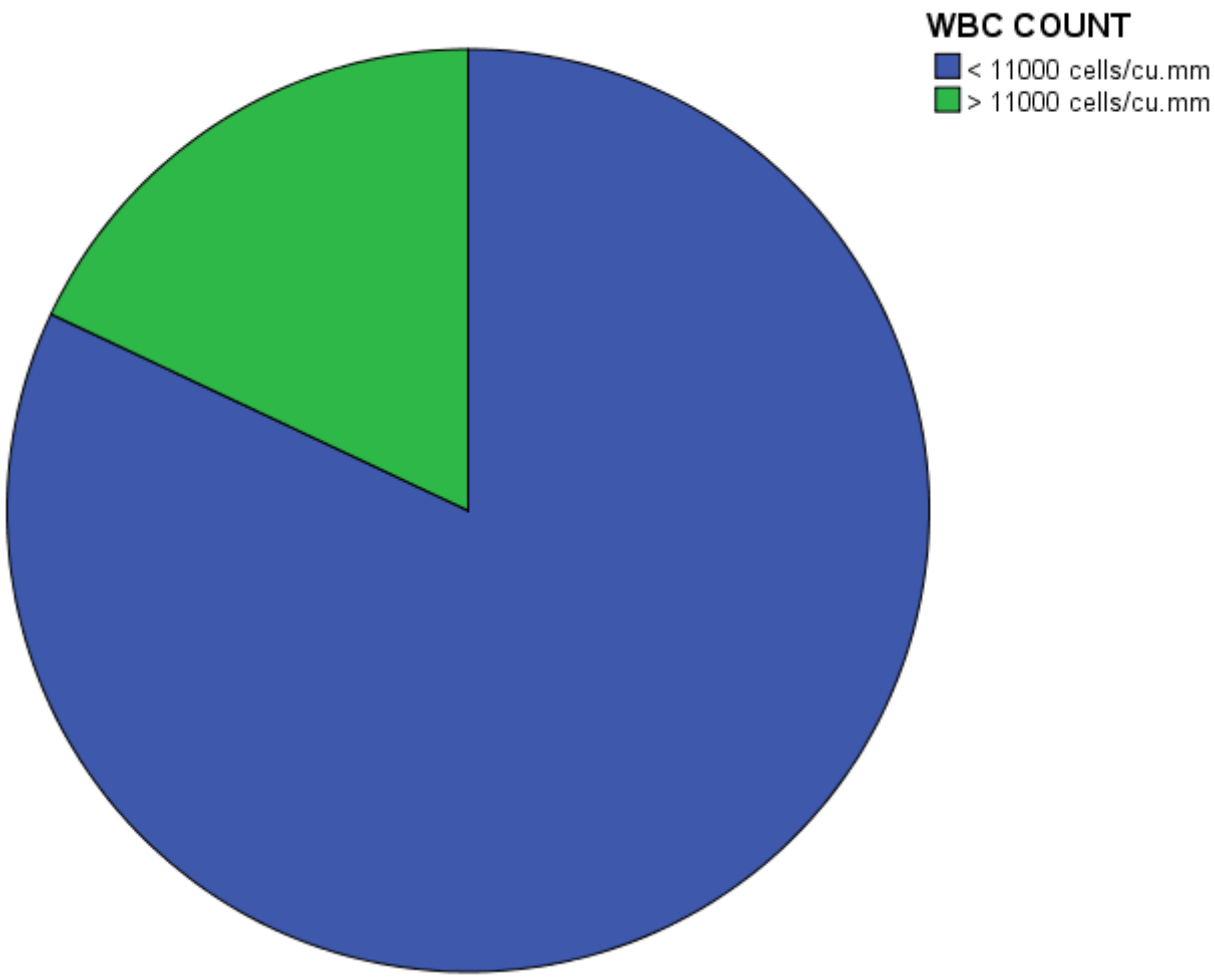


Table 12: Frequency distribution of liver enzymes in patients with blunt injury abdomen

LIVER ENZYMES	Frequency	Percent	Valid Percent	Cumulative Percent
NORMAL	97	97.0	97.0	97.0
ELEVATED	3	3.0	3.0	100.0
Total	100	100.0	100.0	

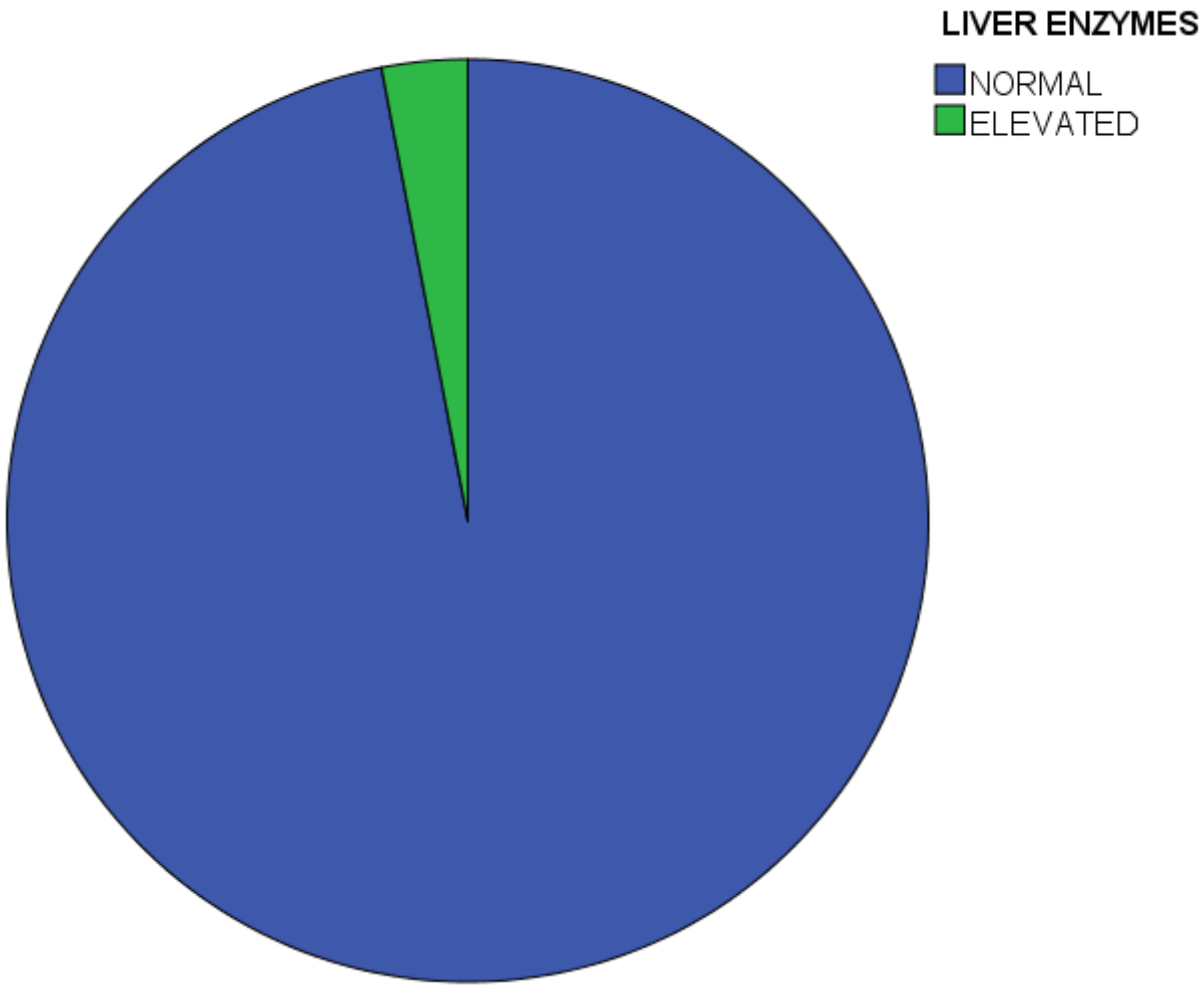


Table 13: Frequency distribution of other significant injuries in patients with blunt injury abdomen

OTHER SIGNIFICANT INJURIES	Frequency	Percent	Valid Percent	Cumulative Percent
ABSENT	58	58.0	58.0	58.0
PRESENT	42	42.0	42.0	100.0
Total	100	100.0	100.0	

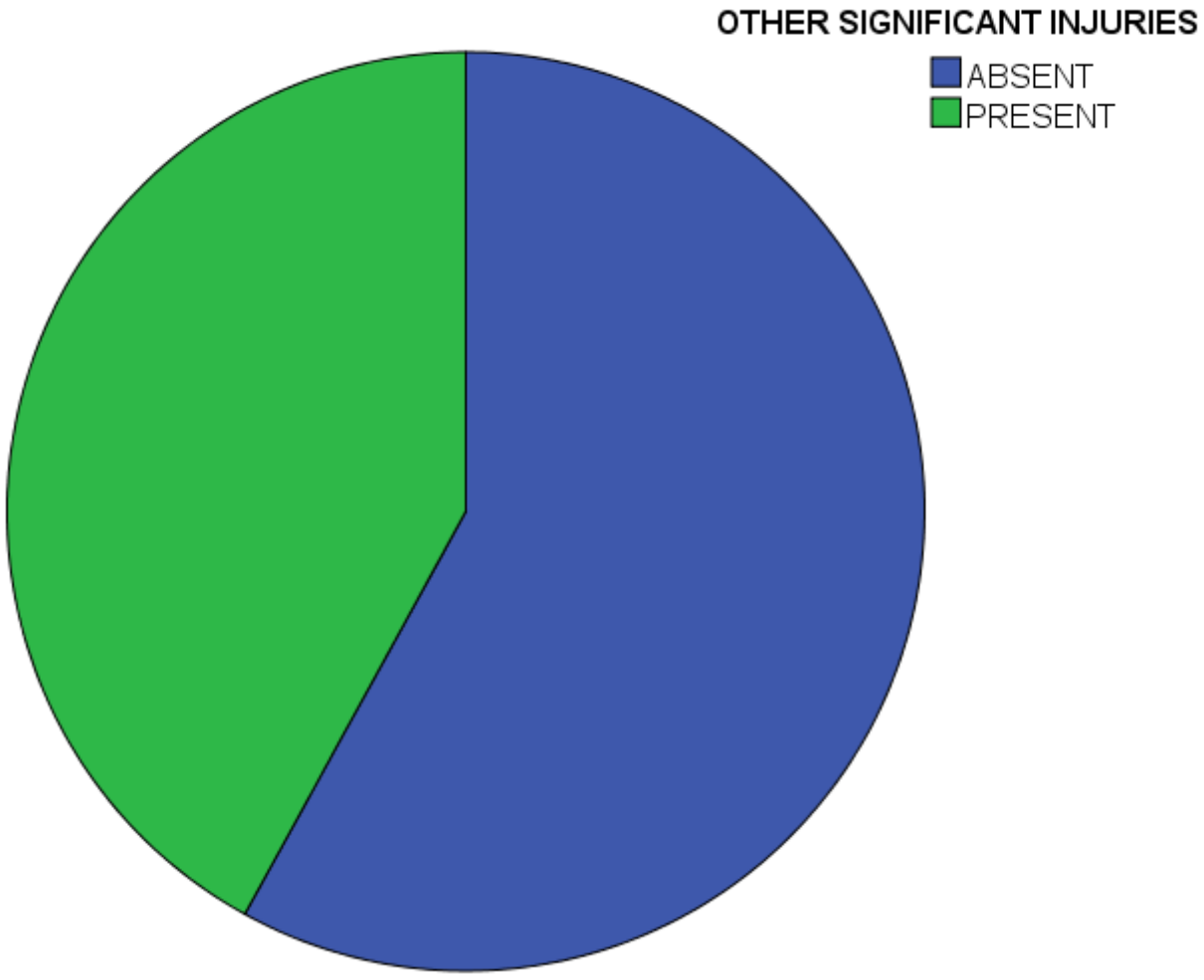


Table 14: AGE VS RISK CROSS TABULATION

Age		RISK			Total
		LOW	INTERMEDIATE	HIGH	
20-29 yrs	Count	15	13	1	29
	% within Age	51.7%	44.8%	3.4%	100.0%
30-39 yrs	Count	13	5	2	20
	% within Age	65.0%	25.0%	10.0%	100.0%
40-49 yrs	Count	12	9	1	22
	% within Age	54.5%	40.9%	4.5%	100.0%
50-59 yrs	Count	9	6	0	15
	% within Age	60.0%	40.0%	0.0%	100.0%
60-69 yrs	Count	7	4	0	11
	% within Age	63.6%	36.4%	0.0%	100.0%
70-75 yrs	Count	1	2	0	3
	% within Age	33.3%	66.7%	0.0%	100.0%
Total	Count	57	39	4	100
	% within Age	57.0%	39.0%	4.0%	100.0%

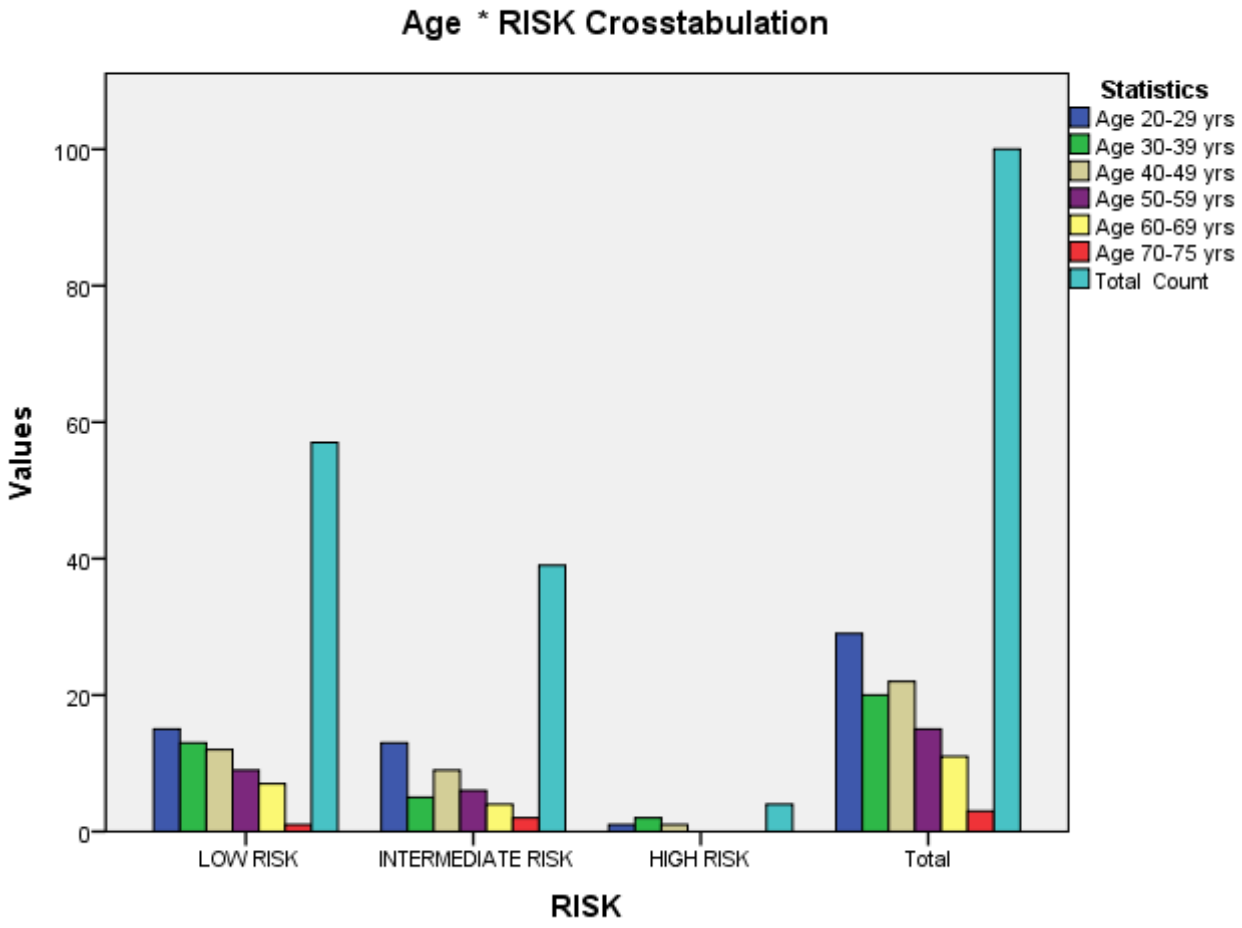

Age * RISK Crosstabulation
Statistics
Age 20-29 yrs
Age 30-39 yrs
Age 40-49 yrs
Age 50-59 yrs
Age 60-69 yrs
Age 70-75 yrs
Total Count
Values
100
80
60
40
20
0
LOW RISK
INTERMEDIATE RISK
HIGH RISK
Total
RISK

Table 15: SEX Vs RISK CROSSTABULATION

SEX		RISK			Total
		LOW	INTERMEDIATE	HIGH	
FEMALE	Count	11	7	0	18
	% within SEX	61.1%	38.9%	0.0%	100.0%
MALE	Count	46	32	4	82
	% within SEX	56.1%	39.0%	4.9%	100.0%
Total	Count	57	39	4	100
	% within SEX	57.0%	39.0%	4.0%	100.0%

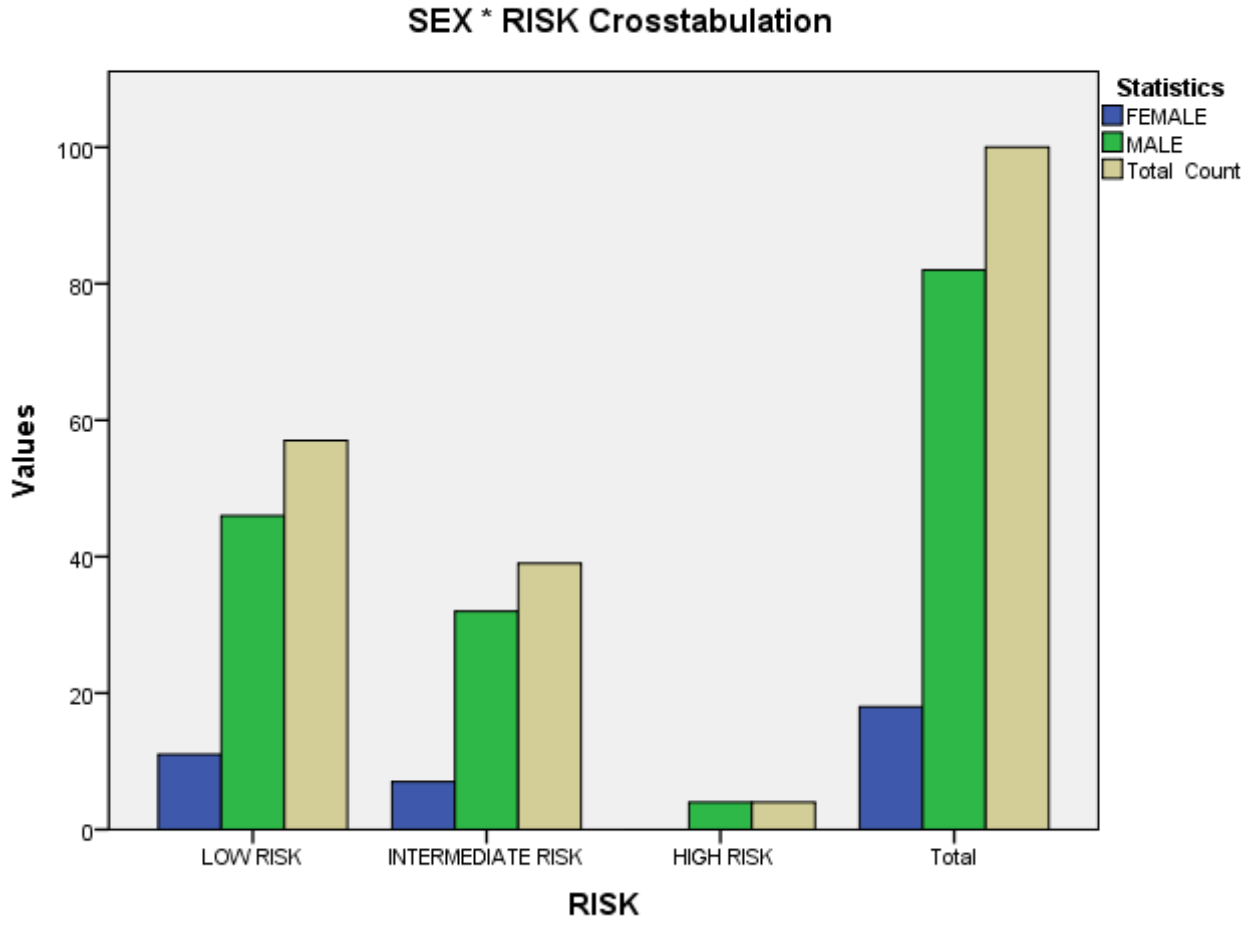


Table 16: ABDOMINAL PAIN Vs RISK CROSSTABULATION

Abdominal pain		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	30	15	0	45
	% within Abdominal pain	66.7%	33.3%	0.0%	100.0%
Present	Count	27	24	4	55
	% within Abdominal pain	49.1%	43.6%	7.3%	100.0%
Total	Count	57	39	4	100
	% within Abdominal pain	57.0%	39.0%	4.0%	100.0%

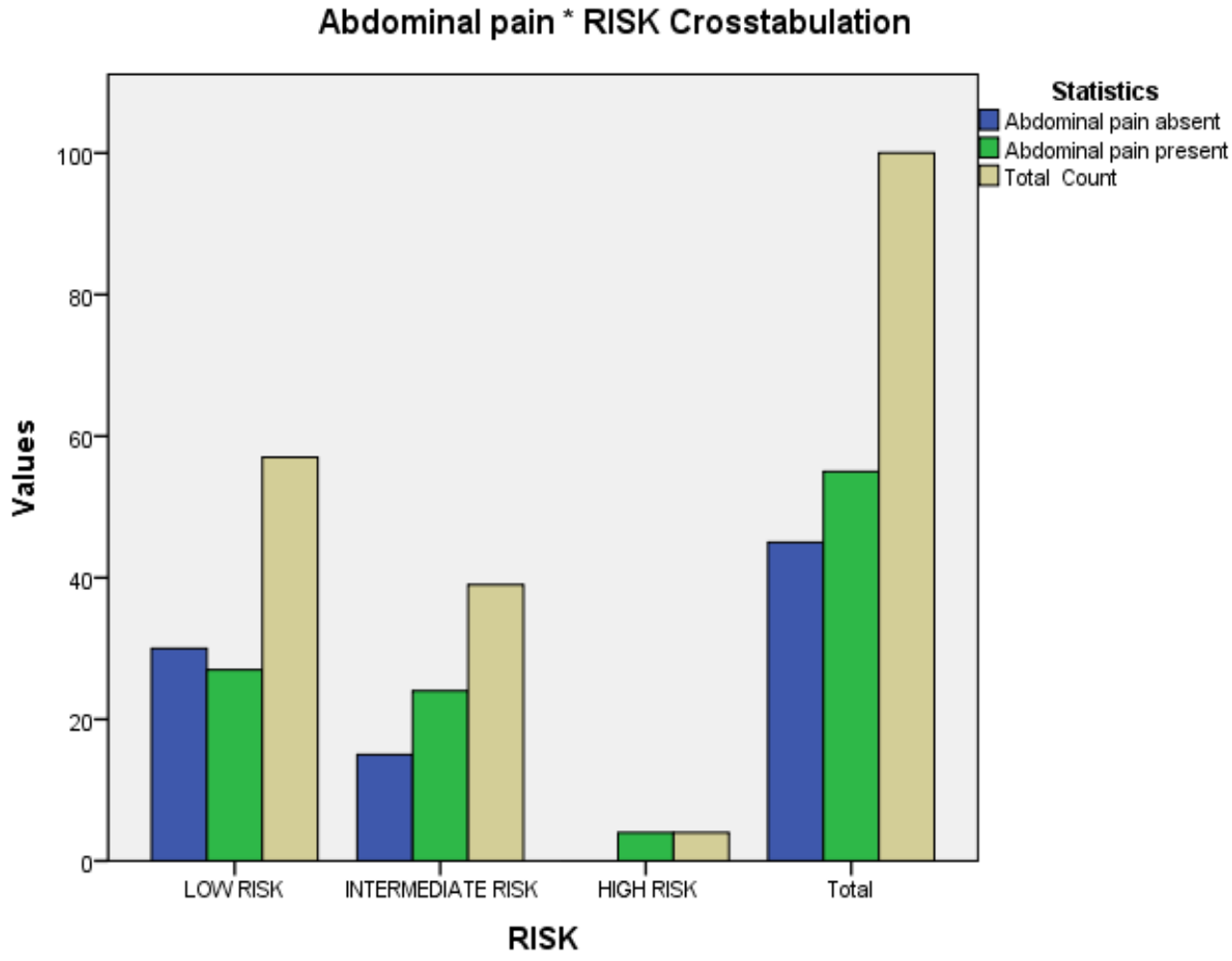


Table 17: PULSE RATE VS RISK CROSSTABULATION

PULSE RATE		RISK			Total
		LOW	INTERMEDIATE	HIGH	
<90 /min	Count	47	9	0	56
	% within PULSE RATE	83.9%	16.1%	0.0%	100.0%
90-110 /min	Count	6	20	0	26
	% within PULSE RATE	23.1%	76.9%	0.0%	100.0%
>110 /min	Count	4	10	4	18
	% within PULSE RATE	22.2%	55.6%	22.2%	100.0%
Total	Count	57	39	4	100
	% within PULSE RATE	57.0%	39.0%	4.0%	100.0%

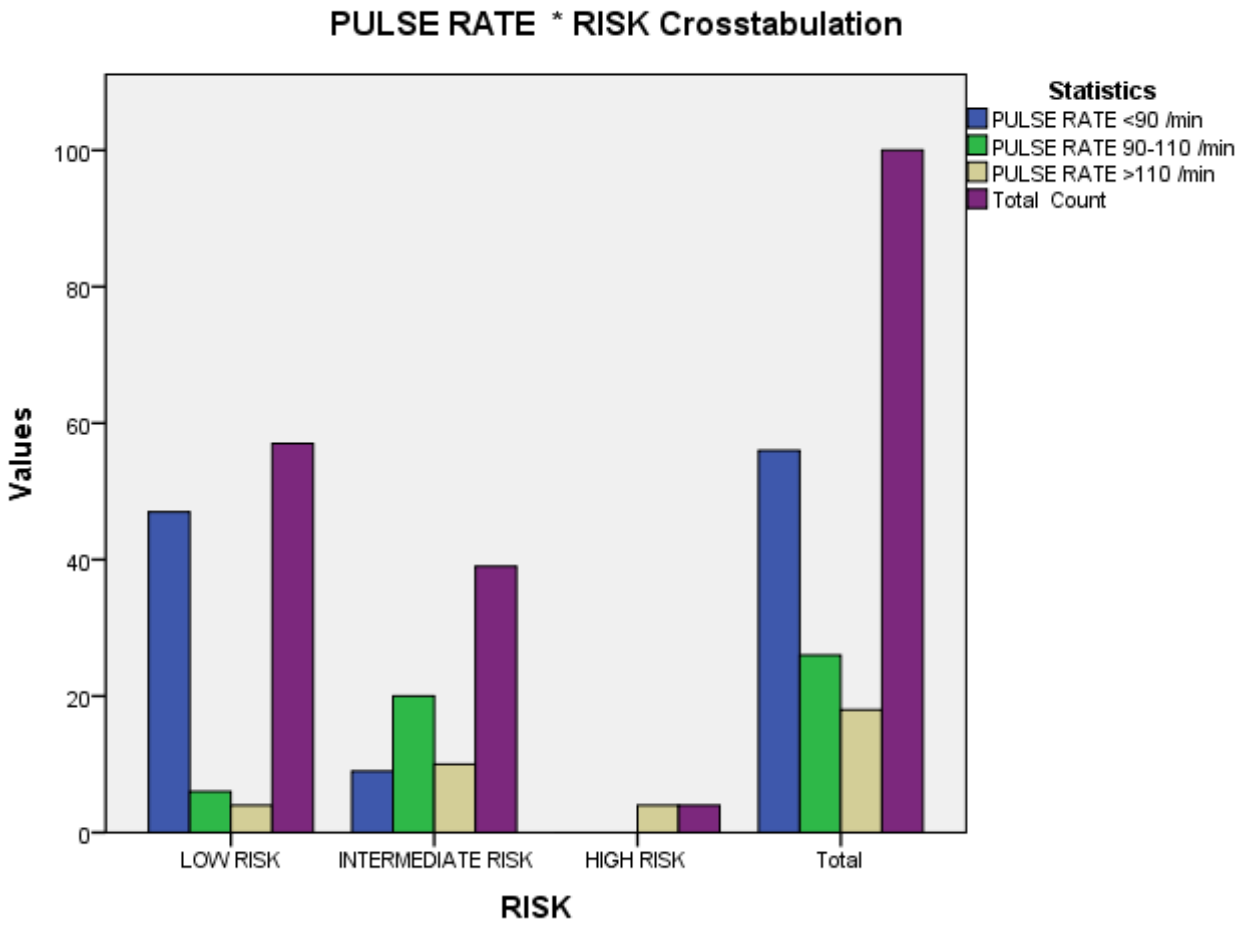


Table 18: SYSTOLIC BLOOD PRESSURE VS RISK CROSSTABULATION

SYSTOLIC BP		RISK			Total
		LOW	INTERMEDIATE	HIGH	
>120 mmHg	Count	48	7	0	55
	% within SYSTOLIC BP	87.3%	12.7%	0.0%	100.0%
90-120 mmHg	Count	9	25	0	34
	% within SYSTOLIC BP	26.5%	73.5%	0.0%	100.0%
<90 mmHg	Count	0	7	4	11
	% within SYSTOLIC BP	0.0%	63.6%	36.4%	100.0%
Total	Count	57	39	4	100
	% within SYSTOLIC BP	57.0%	39.0%	4.0%	100.0%

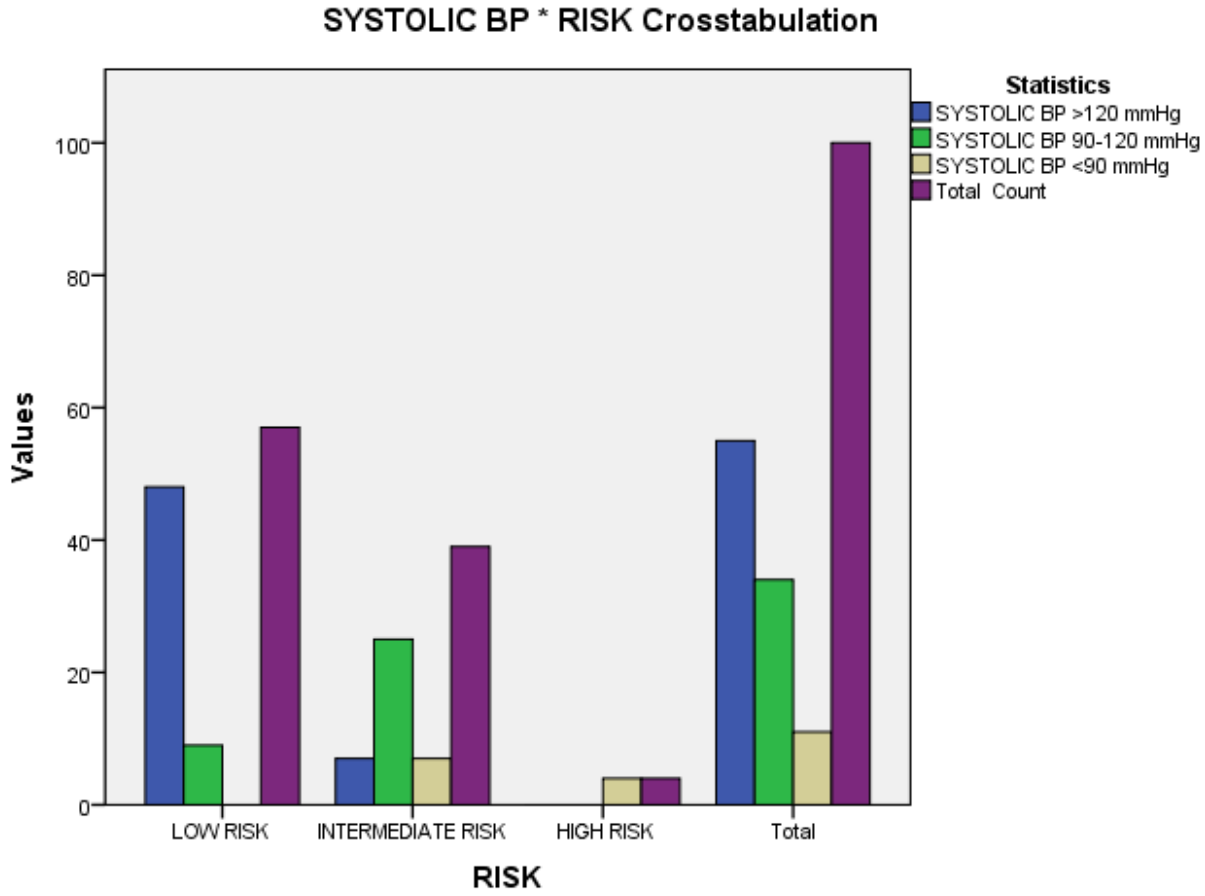


Table 19: PERITONITIS Vs RISK CROSSTABULATION

PERITONITIS		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	57	39	2	98
	% within PERITONITIS	58.2%	39.8%	2.0%	100.0%
Present	Count	0	0	2	2
	% within PERITONITIS	0.0%	0.0%	100.0%	100.0%
Total	Count	57	39	4	100
	% within PERITONITIS	57.0%	39.0%	4.0%	100.0%

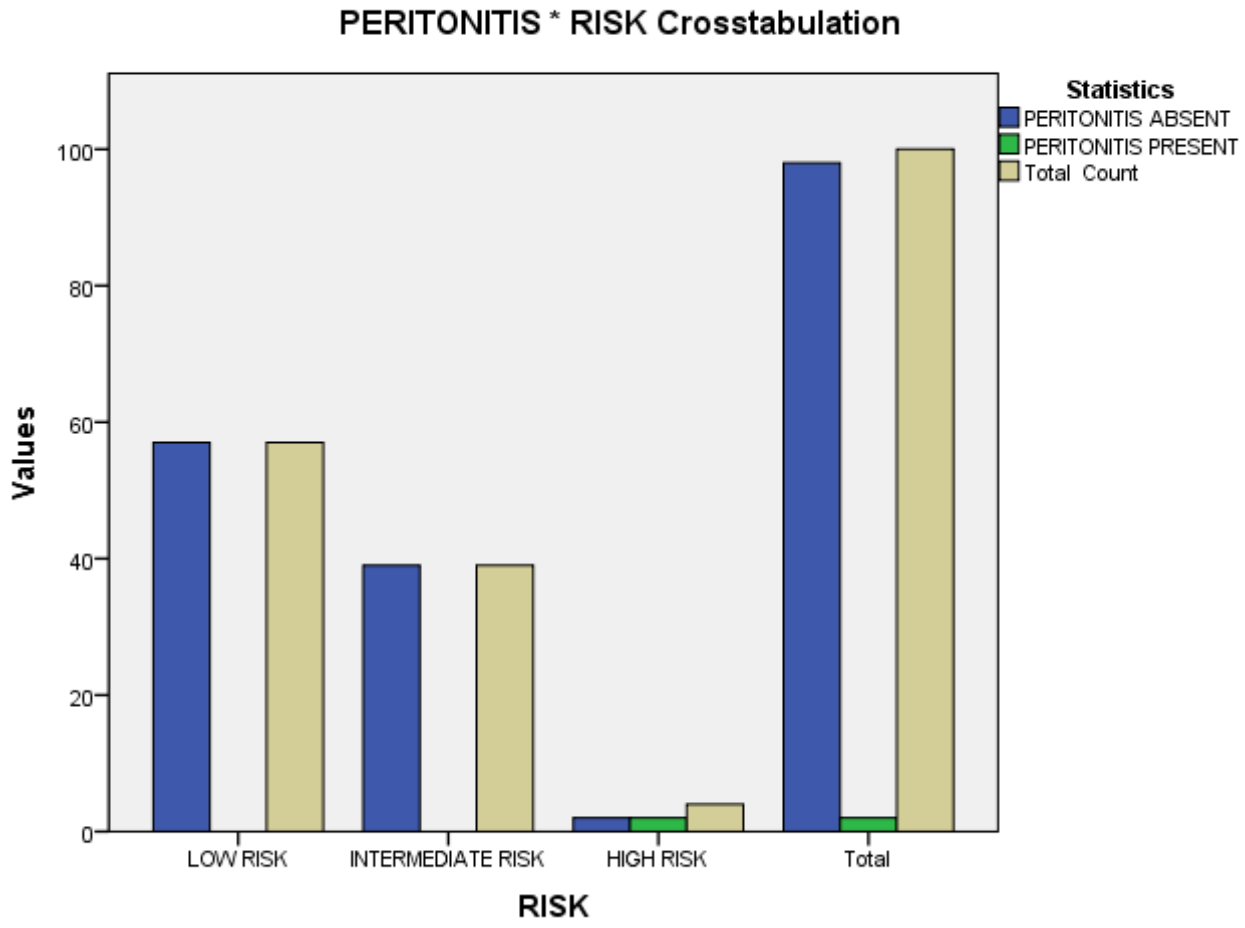


Table 20: FREE FLUID VS RISK CROSSTABULATION

FREE FLUID		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	57	38	0	95
	% within FREE.FLUID	60.0%	40.0%	0.0%	100.0%
Present	Count	0	1	4	5
	% within FREE.FLUID	0.0%	20.0%	80.0%	100.0%
Total	Count	57	39	4	100
	% within FREE.FLUID	57.0%	39.0%	4.0%	100.0%

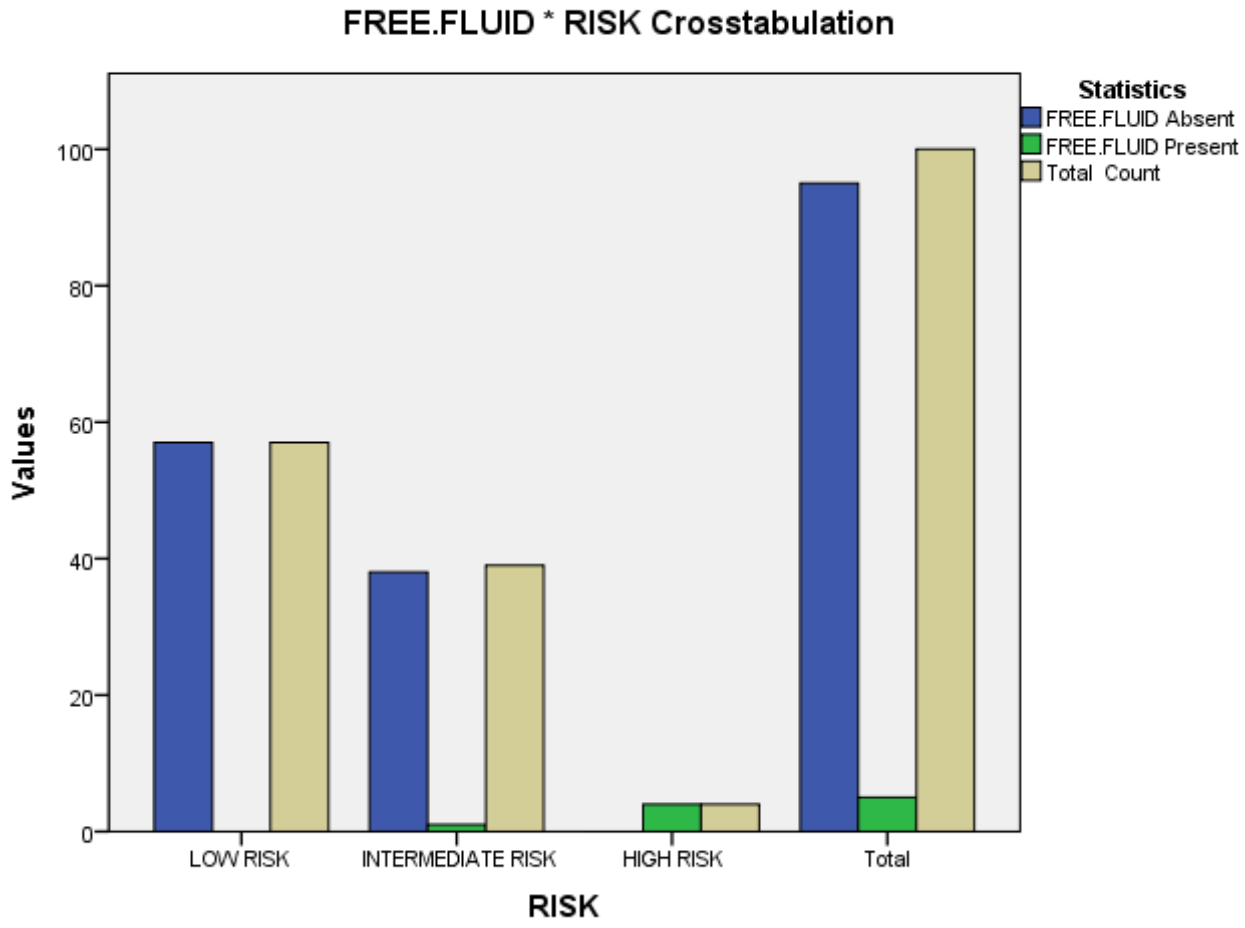


Table 21: IMAGING VS RISK CROSSTABULATION

IMAGING		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	30	0	87
	% within IMAGING	65.5%	34.5%	0.0%	100.0%
Free Fluid	Count	0	9	2	11
	% within IMAGING	0.0%	81.8%	18.2%	100.0%
Solid organ injury	Count	0	0	2	2
	% within IMAGING	0.0%	0.0%	100.0%	100.0%
Total	Count	57	39	4	100
	% within IMAGING	57.0%	39.0%	4.0%	100.0%

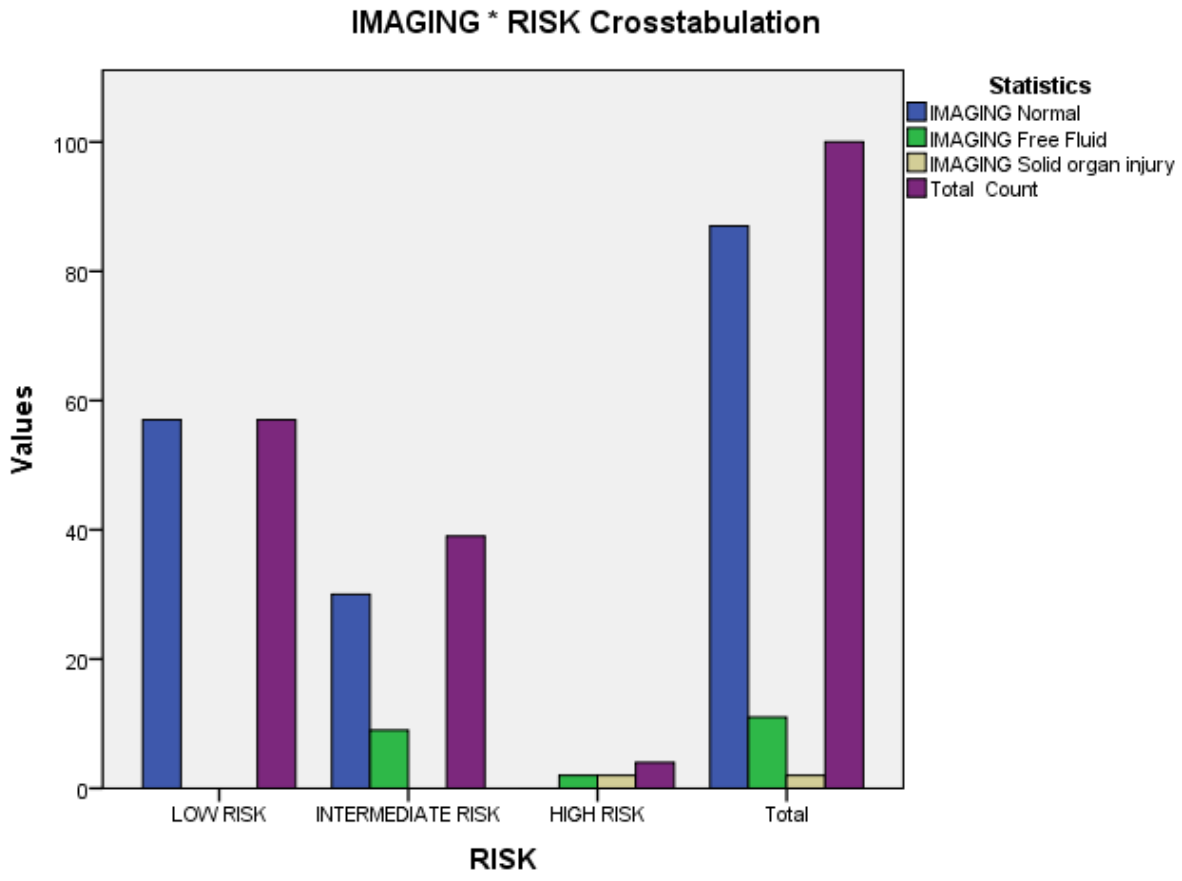


Table 22: SERUM CREATININE VS RISK CROSSTABULATION

SR.CREAT		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	35	4	96
	% within SR.CREAT	59.4%	36.5%	4.2%	100.0%
Elevated	Count	0	4	0	4
	% within SR.CREAT	0.0%	100.0%	0.0%	100.0%
Total	Count	57	39	4	100
	% within SR.CREAT	57.0%	39.0%	4.0%	100.0%

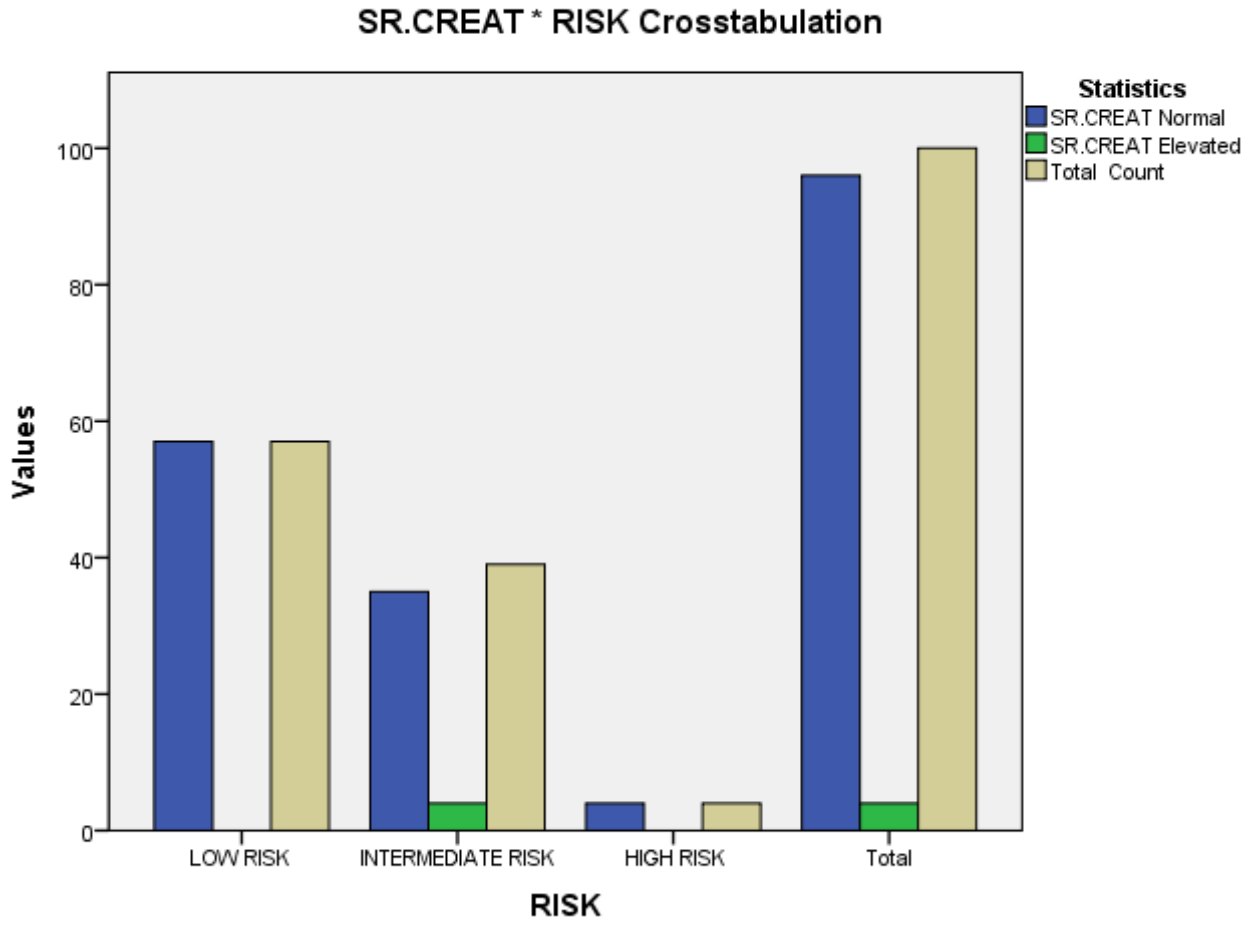


Table 23: WHITE BLOOD CELL COUNT VS RISK CROSSTABULATION

WBC COUNT		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	56	26	0	82
	% within WBC.COUNT	68.3%	31.7%	0.0%	100.0%
Elevated	Count	1	13	4	18
	% within WBC.COUNT	5.6%	72.2%	22.2%	100.0%
Total	Count	57	39	4	100
	% within WBC.COUNT	57.0%	39.0%	4.0%	100.0%

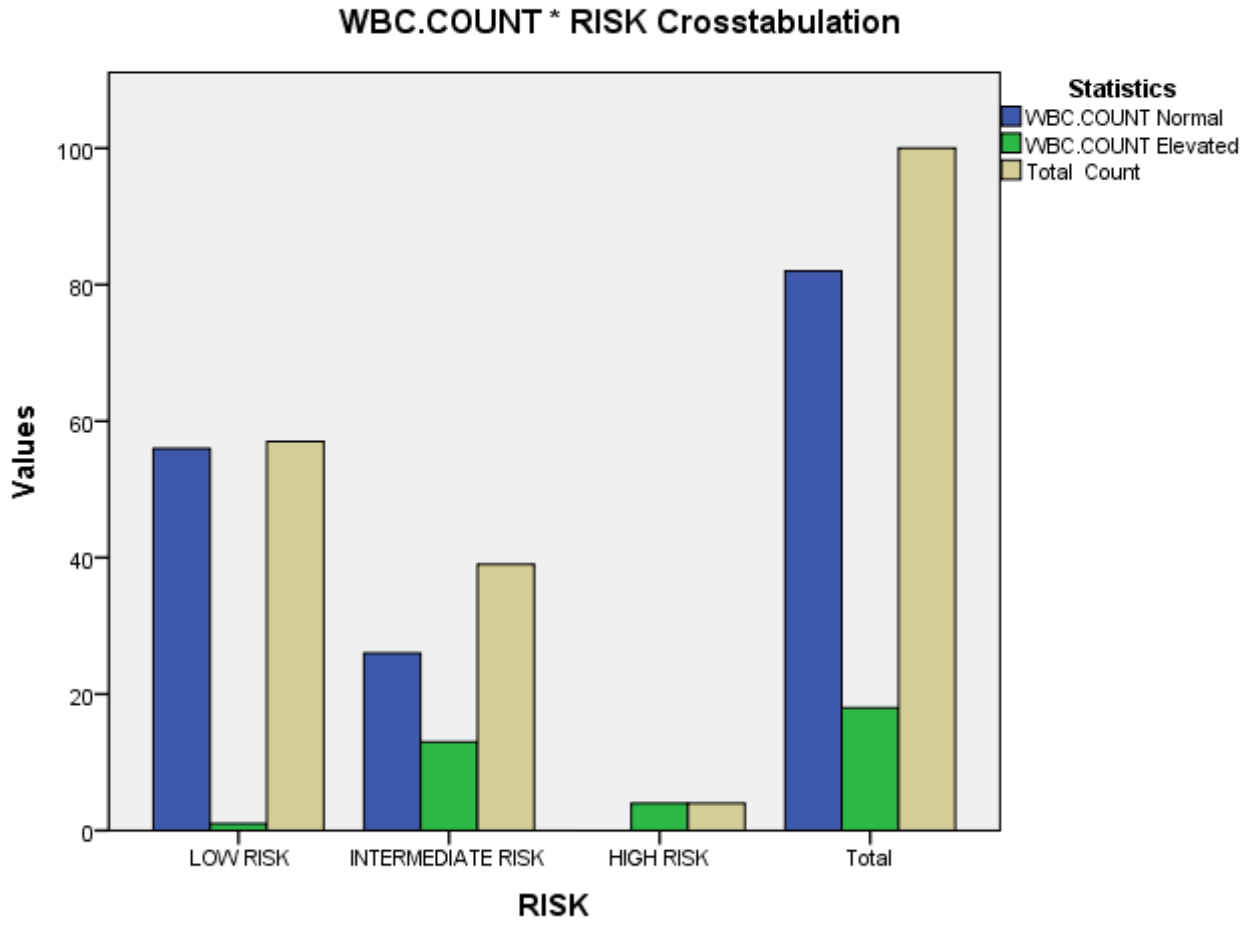


Table 24: LIVER ENZYMES VS RISK CROSSTABULATION

Liver Enzymes		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	38	2	97
	% within Liver Enzymes	58.8%	39.2%	2.1%	100.0%
Elevated	Count	0	1	2	3
	% within Liver Enzymes	0.0%	33.3%	66.7%	100.0%
Total	Count	57	39	4	100
	% within Liver Enzymes	57.0%	39.0%	4.0%	100.0%

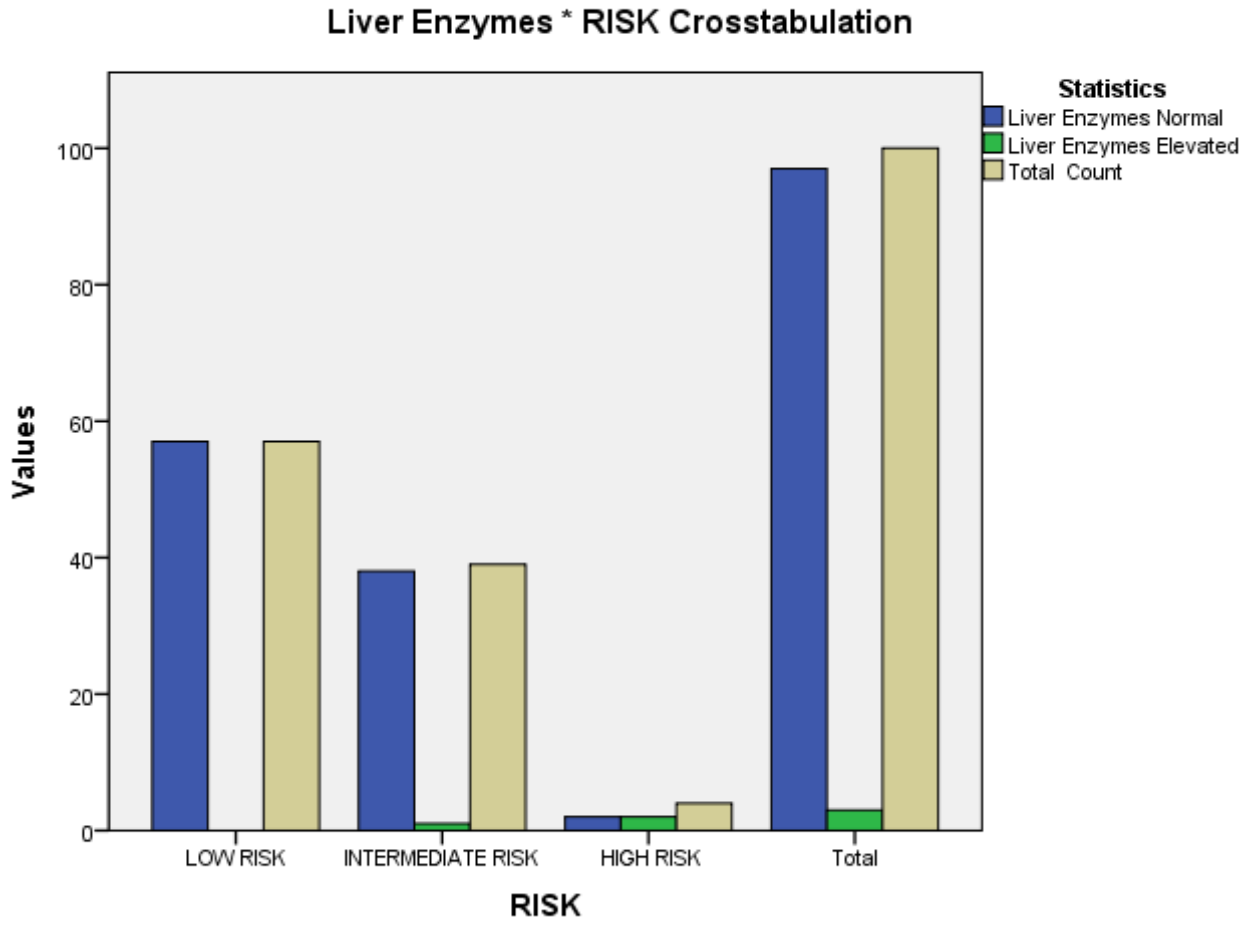
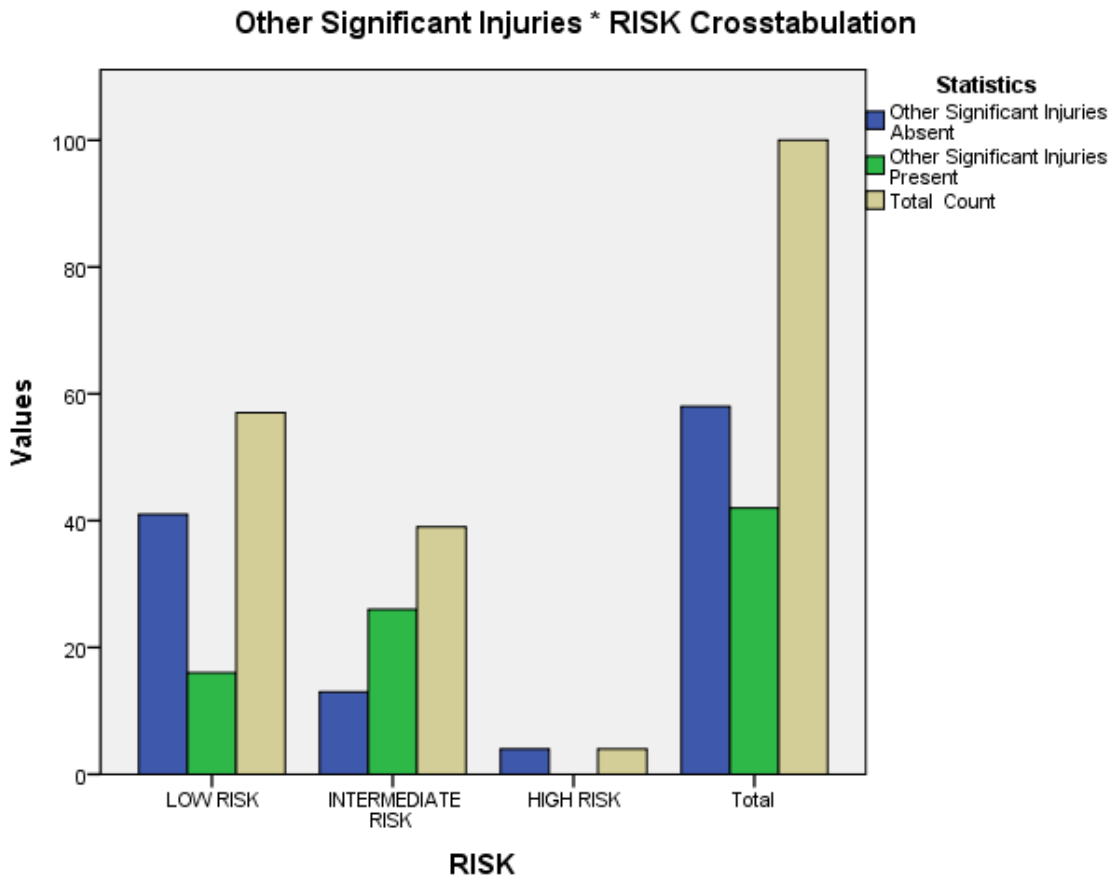


Table 25:OTHER SIGNIFICANT INJURIES VS RISK CROSSTABULATION

Other Significant Injuries		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	41	13	4	58
	% within Other Significant Injuries	70.7%	22.4%	6.9%	100.0%
Present	Count	16	26	0	42
	% within Other Significant Injuries	38.1%	61.9%	0.0%	100.0%
Total	Count	57	39	4	100
	% within Other Significant Injuries	57.0%	39.0%	4.0%	100.0%



Discussion

This prospective and observational study was conducted among 100 randomly selected patients with blunt injury abdomen in Institute of General Surgery, Madras Medical College and Rajiv Gandhi Government Hospital. The study was carried out with a view to devise a score to decide the management of blunt injury abdomen, after taking into account the ten important parameters.

Age of 100 patients ranged from 20 to 72 years. Most of the patients (29%) were between 20-29 years (table 1); with mean age of 39.99 years and standard deviation of 14.255 years. The commonest age group of patients in this study are compared with other studies,

Table 26:

Study	**Commonest age group**
Nabachandra H. et al(2006)	21-30 yrs (20.80%)
Mousami Singh et al(2012)	21-30 yrs (21.2%)
Present study	20-29 yrs (29%)

*Figures in parenthesis indicates percentages

Among the study participants, 82% were males and 18% were females (table 2). The male to female ratio was 4.5: 1. So, males were the predominantly involved group.

Table 27: Sex ratio compared with other studies

Study	**Sex ratio (M:F)**
Nabachandra H. et al(2006)	3.8:1
Mousami Singh et al(2012)	4:1
Shojaee M. et al(2014)	4.2:1
Present study	4.5:1

Among the patients in this study the most common mode of injury(table 3) was Road traffic accident(RTA) which accounted for 67% of blunt injury abdomen, followed by assault (12%), fall from height (11%), others[fall of object, occupational, accidental fall] (9%) and Train traffic accident (1%). In the studies conducted by Nabachandra H. et al (India) and Mousami Singh et al (India) also revealed that Road traffic accident (RTA) was the leading cause for blunt injury abdomen, 86.4% and 70% respectively.

A 30-point blunt abdominal injury scoring system based on 10 important parameters was developed. The points table is given below;

Parameters
Abdominal pain Absent – 1 point Present- 2 points
Pulse rate <90 /min – 1 point 90-110 /min – 2 points >110 /min – 3 points
Systolic blood pressure >120 mmHg – 1 point 90-120 mmHg -2 points <90 mmHg – 3 points
Peritonitis Absent – 1 point Present – 4 points

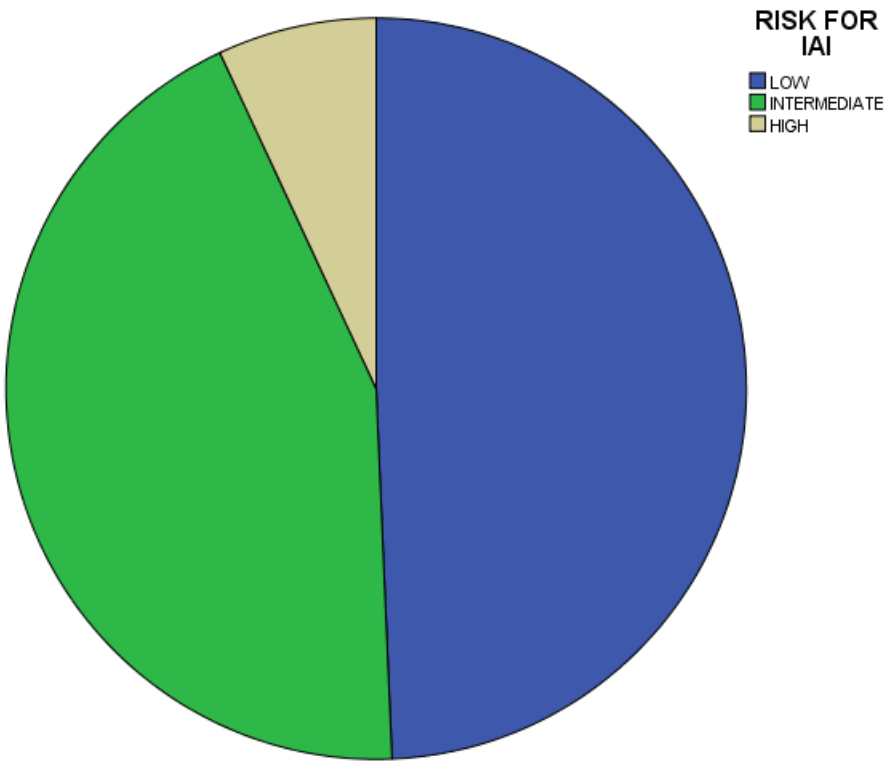
Free fluid Absent – 1 point Present – 4 points
Imaging Normal – 1 point Free fluid – 2 points Solid organ injury – 3 points
Serum creatinine < 1.4 mg/dl– 1 point >1.4 mg/dl – 3 points
White blood cell count < 10,000 cells/cu.mm – 1 point >10,000 cells/cu.mm – 2 points
Liver enzymes(AST/ALT) Normal – 1 point Elevated – 3 points
Other significant injuries Absent – 1 point Present – 3 points

Based upon the above scoring system and outcome (discharged / observation/ laparotomy) the patients were divided into three groups – low risk, intermediate risk and high risk. Scores of 14 and 18 were considered the cut-off points. Patient with a score <14 were identified as low risk for intra-abdominal injury (IAI). Scores of ≥ 18 were identified as high risk for IAI. Scores between 14 and18 were identified as intermediate risk for IAI.

Table 27: Frequency distribution of risk for IAI

RISK	Frequency	Percent	Valid Percent	Cumulative Percent
LOW	57	57.0	57.0	57.0
INTERMEDIATE	39	39.0	39.0	96.0
HIGH	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Predominantly most blunt injury abdomen patients in the study were identified as low risk for IAI (score < 14) as seen in above table 27, accounting for 57% of study patients.



A similar study by Shojaee et al, a 24-point scoring system and with cut-off values of score as 8 and 12 had similar distribution of risk pattern for IAI. Here also most blunt injury abdomen patients were identified as low risk for IAI (score < 8), accounting for 70.11%.

Table 28: Comparison of distribution of Risk for IAI

STUDY	LOW RISK (n, %)	INTERMEDIATE RISK (n, %)	HIGH RISK (n, %)	Total (n, %)
Shojaee et al(2014)	182(69.7%)	41(15.7%)	38(14.6%)	261(100%)
Present study	57(57%)	39(39%)	4(4%)	100(100%)

Out of the 100 patients with blunt injury abdomen in our study, only thirteen (13%) patients had Intra-abdominal injury (IAI). Though blunt injury abdomen is a common entity in our trauma wards, the prevalence of Intra-abdominal injury is low. This is comparable with the study conducted by Shojaee et al, in their study out of the total 261 patients with blunt injury abdomen; only forty eight (18.4%) patients had intra-abdominal injury (IAI).

Table 29: Inter-study comparison of prevalence of IAI

Study	**Prevalence of IAI (n, %)**
Shojaee et al(2014)	48(18.4%)
Present study	13(13%)

Patients in the age group of 30-39 years (table 14) with blunt injury abdomen were found to be more at risk for Intra-abdominal injury, whereas in the study conducted by Shojaee et al 21-30 years age group patients were more at risk for intra-abdominal injury.

Table 15: SEX Vs RISK CROSSTABULATION

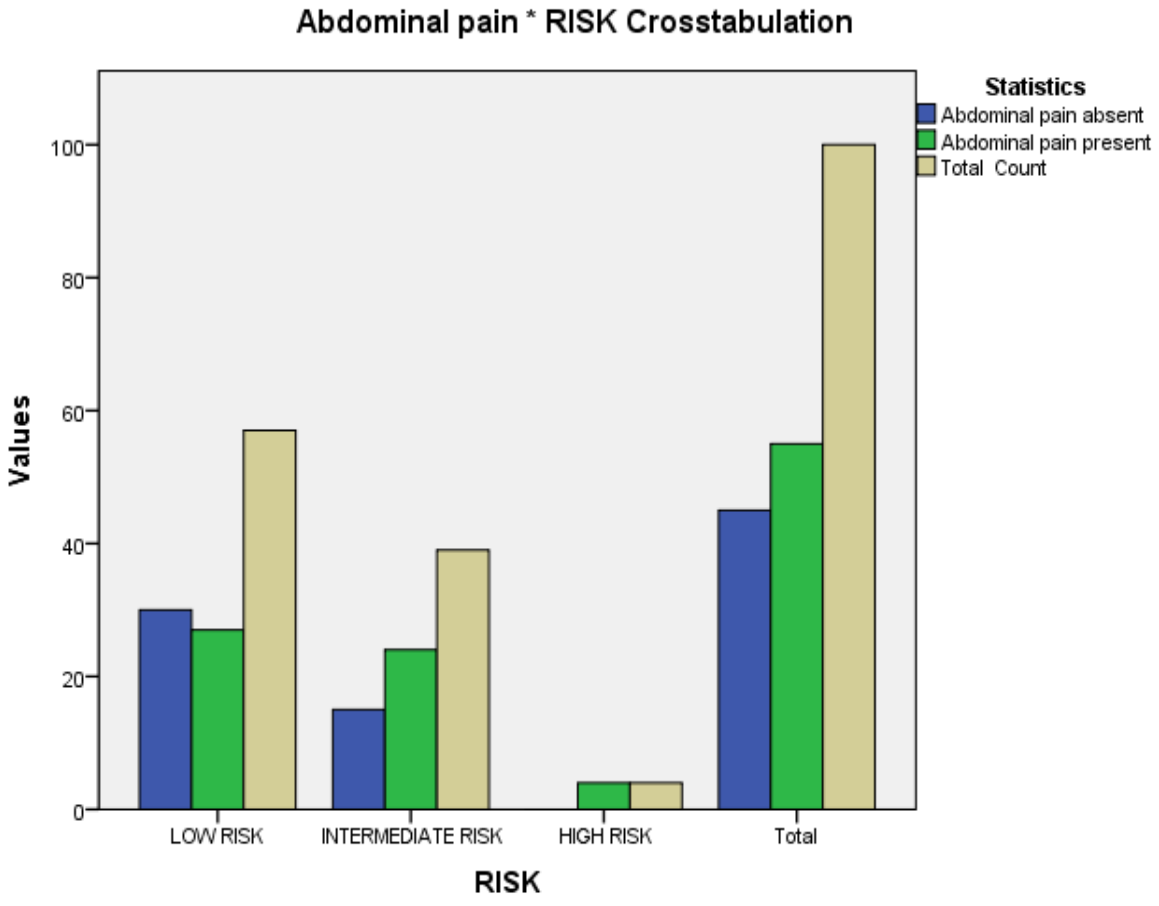
SEX		RISK			Total
		LOW	INTERMEDIATE	HIGH	
FEMALE	Count	11	7	0	18
	% within SEX	61.1%	38.9%	0.0%	100.0%
MALE	Count	46	32	4	82
	% within SEX	56.1%	39.0%	4.9%	100.0%
Total	Count	57	39	4	100
	% within SEX	57.0%	39.0%	4.0%	100.0%

As far as gender prevalence of intra-abdominal injury (IAI) in blunt injury abdomen in this study is considered males (table 15) are more at risk compared to females, this bias may be due to the high male to female ratio (4.5:1) in patients with blunt injury abdomen. This is comparable to other studies conducted by Nabachandra H. et al, Mousami Singh et al and Shojaee et al.

This study is based on evaluation of blunt injury abdomen patients based on ten important parameters, which are going to be discussed as follows.

Table 16: ABDOMINAL PAIN Vs RISK CROSSTABULATION

Abdominal pain		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	30	15	0	45
	% within Abdominal pain	66.7%	33.3%	0.0%	100.0%
Present	Count	27	24	4	55
	% within Abdominal pain	49.1%	43.6%	7.3%	100.0%
Total	Count	57	39	4	100
	% within Abdominal pain	57.0%	39.0%	4.0%	100.0%



Abdominal pain is an important clinical parameter in blunt injury abdomen. In our study fifty five (55%) patients with blunt injury abdomen had abdominal pain (table 4). Out of 55 patients with abdominal pain only 4 (7.3%) patients were identifies as high risk for blunt injury abdomen (table 16).

Table 30:

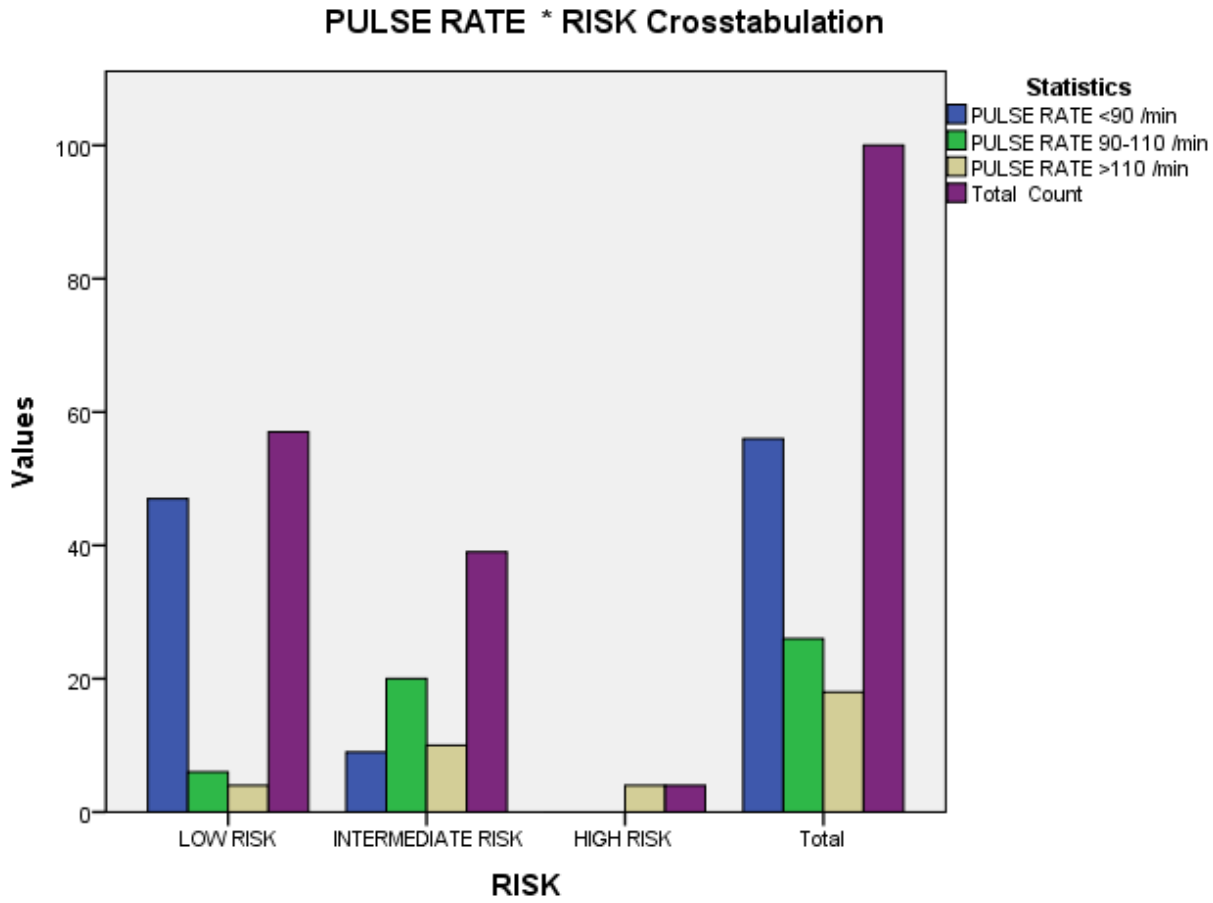
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.288	2	.071
Likelihood Ratio	6.797	2	.033
Linear-by-Linear Association	4.597	1	.032
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 5.288 and degree of freedom of 2, the p value obtained is 0.071 which is >0.05 and hence is insignificant.

Hence there is no statistical correlation between abdominal pain and risk of IAI, outcome & management of blunt injury abdomen.

Table 17: PULSE RATE VS RISK CROSSTABULATION

PULSE RATE		RISK			Total
		LOW	INTERMEDIATE	HIGH	
<90 /min	Count	47	9	0	56
	% within PULSE RATE	83.9%	16.1%	0.0%	100.0%
90-110 /min	Count	6	20	0	26
	% within PULSE RATE	23.1%	76.9%	0.0%	100.0%
>110 /min	Count	4	10	4	18
	% within PULSE RATE	22.2%	55.6%	22.2%	100.0%
Total	Count	57	39	4	100
	% within PULSE RATE	57.0%	39.0%	4.0%	100.0%



Fifty six (56%) patients had a pulse rate <90/min, out of the 56 patients, 47(83.9%) patients were identified as low risk for IAI and 9(16.1%) patients were identified as intermediate risk for IAI. Twenty six (26%) patients had a pulse rate between 90-110/min, out of the 26 patients, 6 (23.1%) patients were identified as low risk for IAI and 20(76.9%) patients as intermediate risk for IAI. Eighteen (18%) patients had a pulse rate >110/min, out of the 18 patients 4(22.2%) patients were identified as low risk for IAI, 10(55.6%) as intermediate risk for IAI and 4(22.2%) patients as high risk for IAI (table 17).

Table 31:

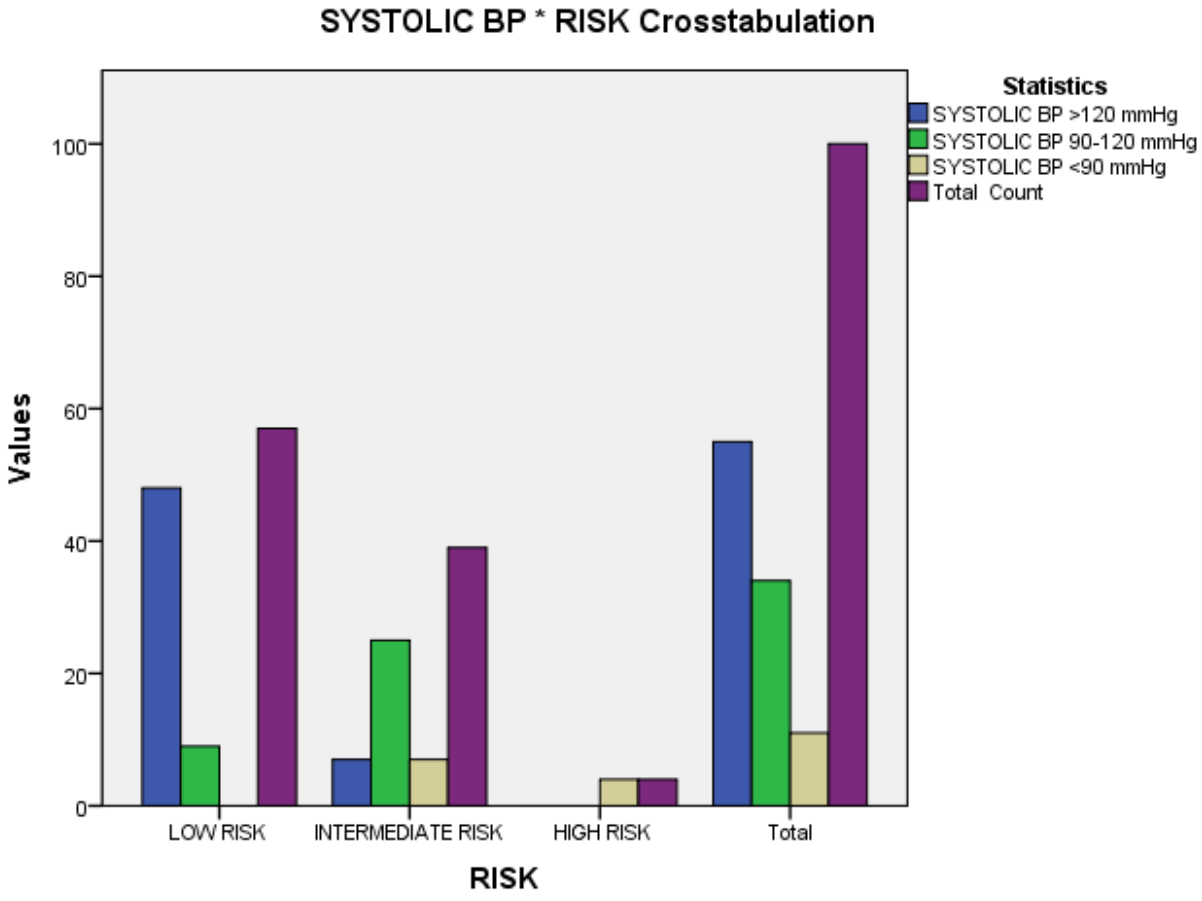
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.817	4	.0001
Likelihood Ratio	49.991	4	.0001
Linear-by-Linear Association	36.439	1	.0001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 52.817 and degree of freedom of 4, the p value obtained is 0.0001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between pulse rate and risk of IAI, outcome & management of blunt injury abdomen.

Table 18: SYSTOLIC BLOOD PRESSURE VS RISK CROSSTABULATION

SYSTOLIC BP		RISK			Total
		LOW	INTERMEDIATE	HIGH	
>120 mmHg	Count	48	7	0	55
	% within SYSTOLIC BP	87.3%	12.7%	0.0%	100.0%
90-120 mmHg	Count	9	25	0	34
	% within SYSTOLIC BP	26.5%	73.5%	0.0%	100.0%
<90 mmHg	Count	0	7	4	11
	% within SYSTOLIC BP	0.0%	63.6%	36.4%	100.0%
Total	Count	57	39	4	100
	% within SYSTOLIC BP	57.0%	39.0%	4.0%	100.0%



Fifty five (55%) patients had a systolic blood pressure >120mmHG, out of the 55 patients, 48(87.3%) patients were identified as low risk for IAI and 7(12.7%) patients were identified as intermediate risk for IAI. Thirty four (34%) patients had a systolic blood pressure between 90-120mmHG, out of the 34 patients, 9 (26.5%) patients were identified as low risk for IAI and 25(73.5%) patients as intermediate risk for IAI. Eleven (11%) patients had a systolic blood pressure <90mmHG, out of the 11 patients, 7(63.6%) patients were identified as intermediate risk for IAI and 4(36.4%) patients as high risk for IAI (table 18).

Table 32:

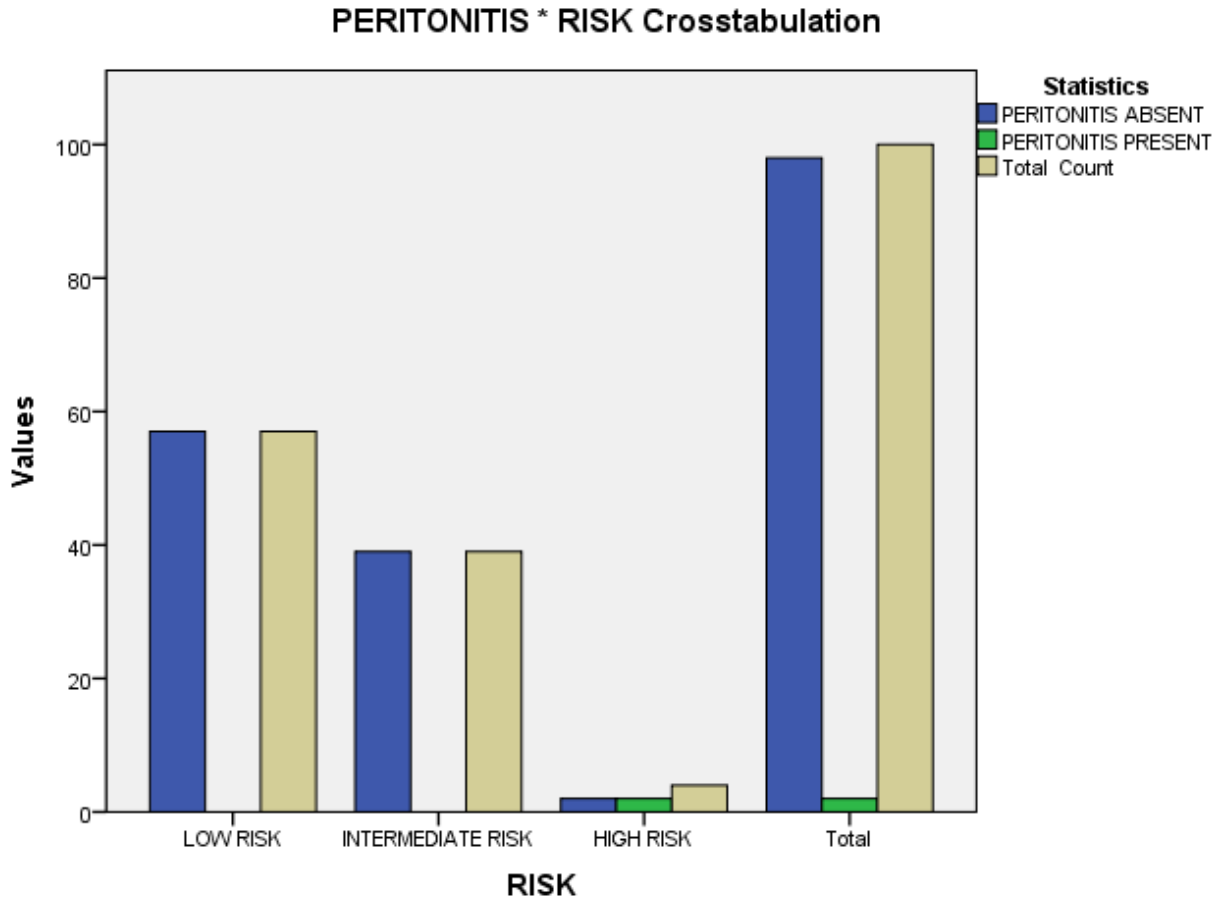
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	74.877	4	.0001
Likelihood Ratio	67.630	4	.0001
Linear-by-Linear Association	53.053	1	.0001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 74.877 and degree of freedom of 4, the p value obtained is 0.0001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between systolic blood pressure and risk of IAI, outcome & management of blunt injury abdomen.

Table 19: PERITONITIS Vs RISK CROSSTABULATION

PERITONITIS		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	57	39	2	98
	% within PERITONITIS	58.2%	39.8%	2.0%	100.0%
Present	Count	0	0	2	2
	% within PERITONITIS	0.0%	0.0%	100.0%	100.0%
Total	Count	57	39	4	100
	% within PERITONITIS	57.0%	39.0%	4.0%	100.0%



Ninety eight (98%) patients had no signs of peritonitis, out of the 98 patients, 57(58.2%) patients were identified as low risk for IAI and 39(39.8%) patients were identified as intermediate risk for IAI. Two (2%) patients had signs of peritonitis and were identified as high risk for IAI (table 19).

Table 33:

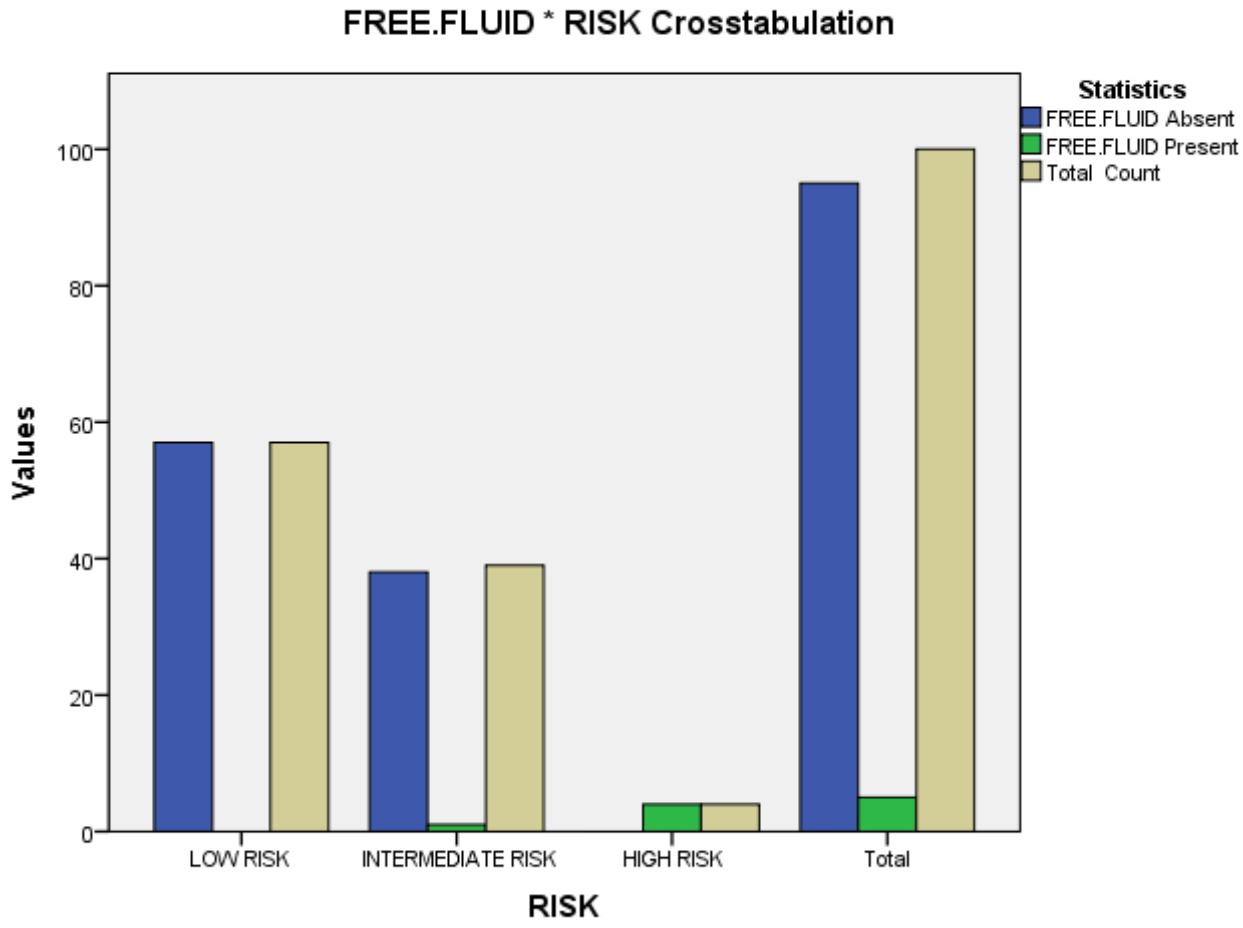
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.980	2	.001
Likelihood Ratio	14.063	2	.001
Linear-by-Linear Association	14.371	1	.001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 48.980 and degree of freedom of 2, the p value obtained is 0.001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between peritonitis and risk of IAI, outcome & management of blunt injury abdomen.

Table 20: FREE FLUID VS RISK CROSSTABULATION

FREE FLUID		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	57	38	0	95
	% within FREE.FLUID	60.0%	40.0%	0.0%	100.0%
Present	Count	0	1	4	5
	% within FREE.FLUID	0.0%	20.0%	80.0%	100.0%
Total	Count	57	39	4	100
	% within FREE.FLUID	57.0%	39.0%	4.0%	100.0%



Ninety five (95%) patients had no clinical signs of free fluid abdomen, out of the 98 patients, 57(60%) patients were identified as low risk for IAI and 38(40%) patients were identified as intermediate risk for IAI. Five (5%) patients had clinical signs of free fluid abdomen, out of the 5 patients, 1(20%) patients were identified as intermediate risk for IAI and 4(80%) patients as high risk for IAI (table 20).

Table 34**:**

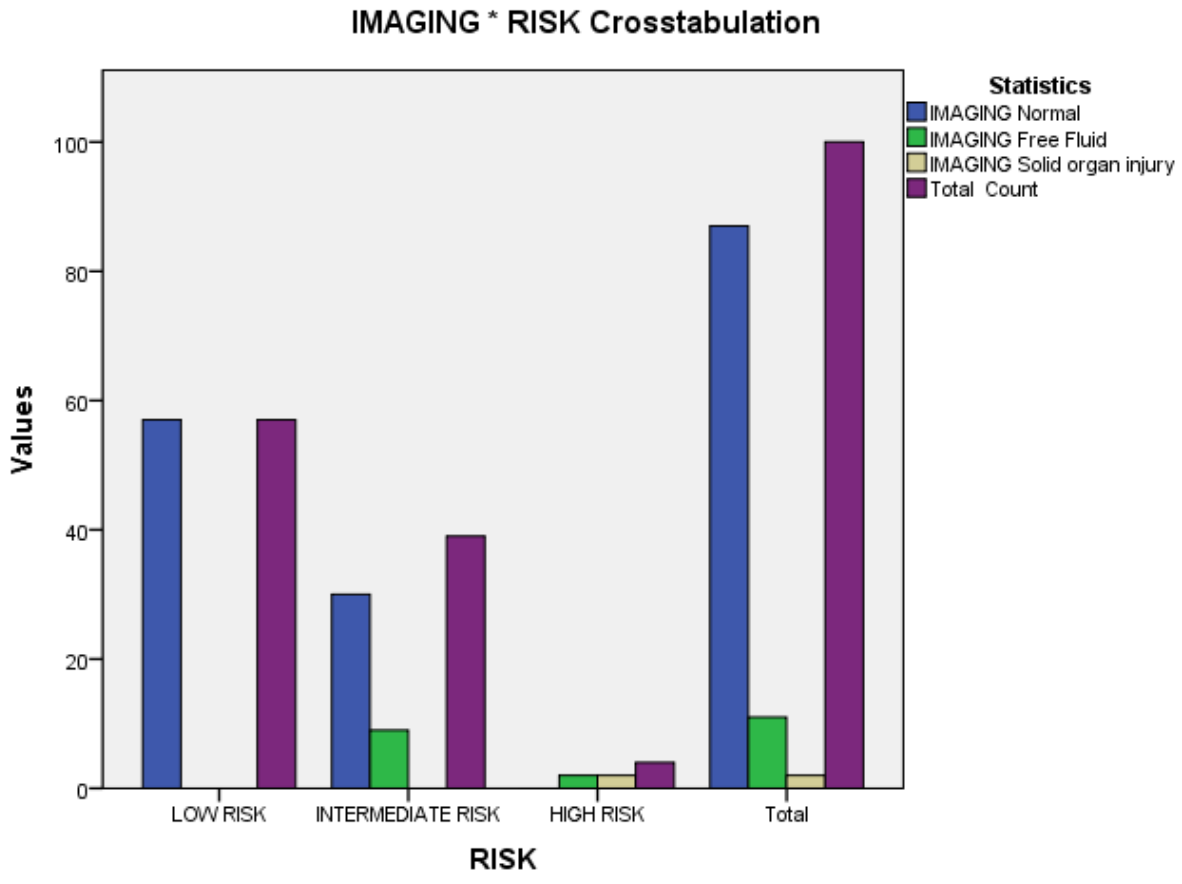
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	79.487	2	.0001
Likelihood Ratio	30.402	2	.0001
Linear-by-Linear Association	28.006	1	.0001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 79.487 and degree of freedom of 2, the p value obtained is 0.0001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between free fluid abdomen and risk of IAI, outcome & management of blunt injury abdomen.

Table 21: IMAGING VS RISK CROSSTABULATION

IMAGING		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	30	0	87
	% within IMAGING	65.5%	34.5%	0.0%	100.0%
Free Fluid	Count	0	9	2	11
	% within IMAGING	0.0%	81.8%	18.2%	100.0%
Solid organ injury	Count	0	0	2	2
	% within IMAGING	0.0%	0.0%	100.0%	100.0%
Total	Count	57	39	4	100
	% within IMAGING	57.0%	39.0%	4.0%	100.0%



Eighty seven (87%) patients had a normal imaging study, out of the 87 patients, 57(65.5%) patients were identified as low risk for IAI and 30(34.5%) patients were identified as intermediate risk for IAI. Eleven (11%) patients had free fluid abdomen by imaging study, out of the 11 patients, 9 (81.8%) patients were identified as intermediate risk for IAI and 2(18.2%) patients as high risk for IAI. Two (2%) patients had solid organ injury by imaging study and were identified as high risk for IAI (table 21).

Table 35:

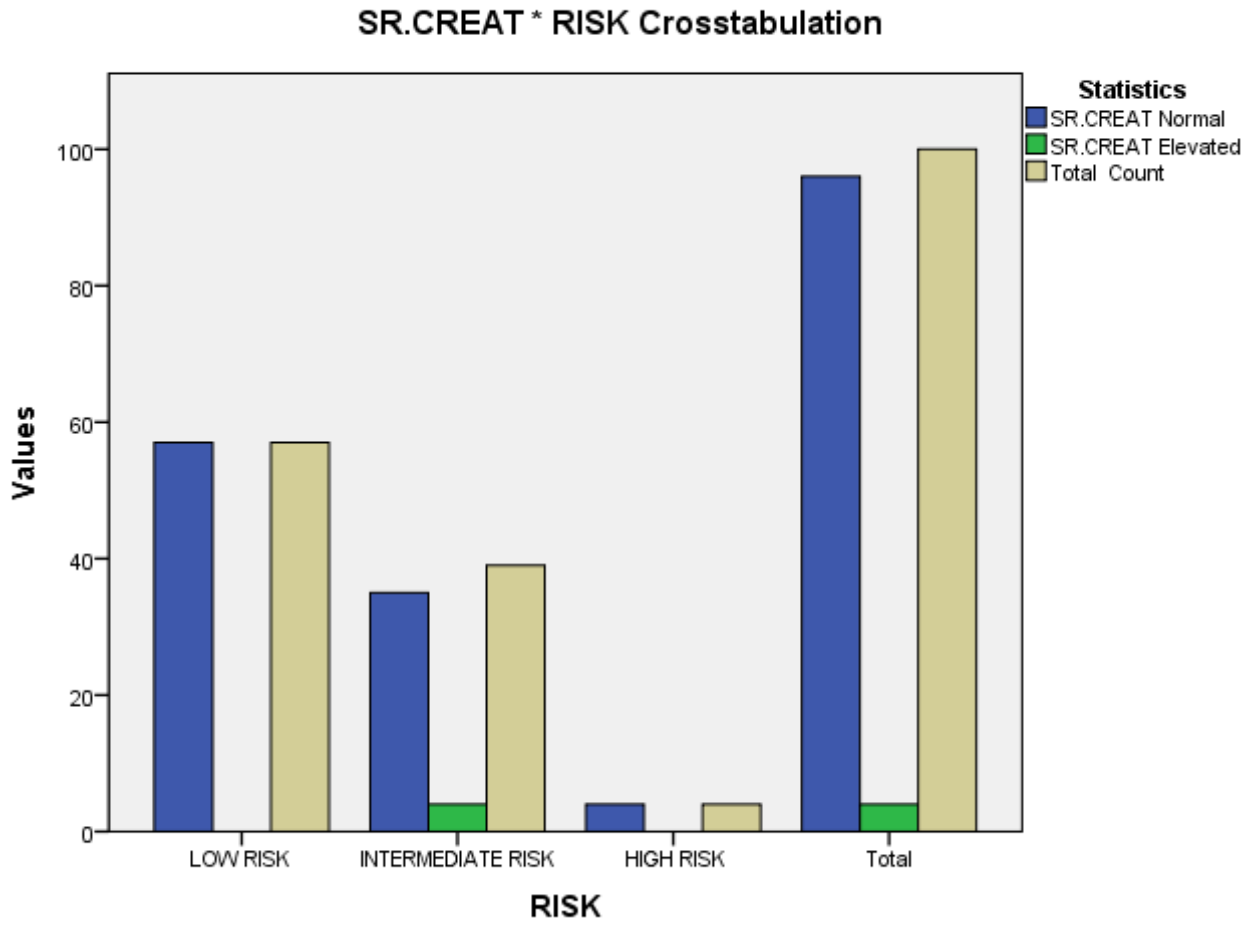
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.014	4	.0001
Likelihood Ratio	40.759	4	.0001
Linear-by-Linear Association	34.949	1	.0001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 70.014 and degree of freedom of 4, the p value obtained is 0.0001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between Imaging and risk of IAI, outcome & management of blunt injury abdomen.

Table 22: SERUM CREATININE VS RISK CROSSTABULATION

SR.CREAT		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	35	4	96
	% within SR.CREAT	59.4%	36.5%	4.2%	100.0%
Elevated	Count	0	4	0	4
	% within SR.CREAT	0.0%	100.0%	0.0%	100.0%
Total	Count	57	39	4	100
	% within SR.CREAT	57.0%	39.0%	4.0%	100.0%



Ninety six (96%) patients had normal serum creatinine, out of the 96 patients, 57(59.4%) patients were identified as low risk for IAI, 35(36.5%) patients were identified as intermediate risk for IAI and 4(4.2%) patients were identified as high risk for IAI. Four (4%) patients had elevated serum creatinine and all were identified as intermediate risk for IAI (table 22).

Table 36**:**

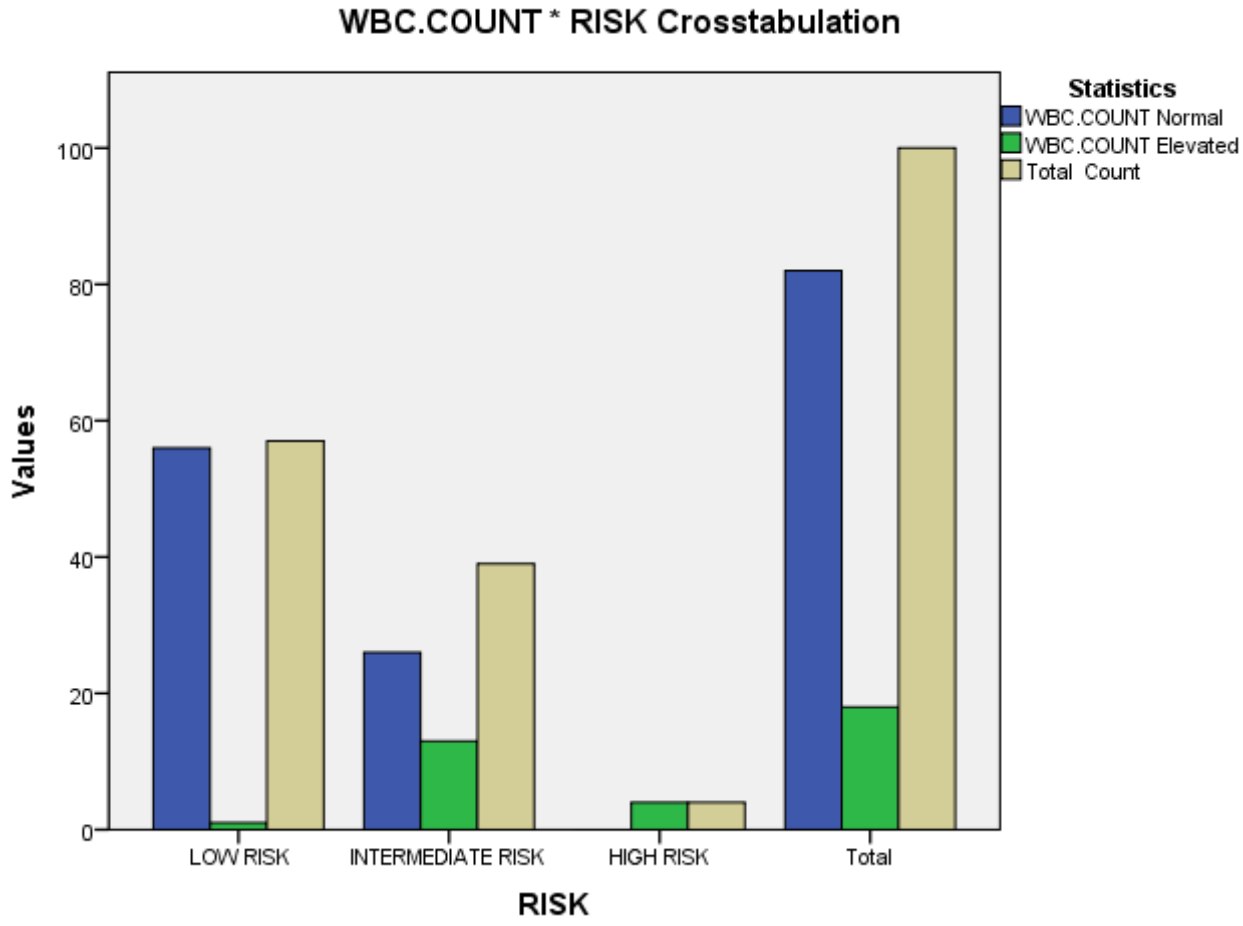
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.517	2	.038
Likelihood Ratio	7.796	2	.020
Linear-by-Linear Association	3.521	1	.061
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 6.517 and degree of freedom of 2, the p value obtained is 0.038 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between serum creatinine and risk of IAI, outcome & management of blunt injury abdomen.

Table 23: WHITE BLOOD CELL COUNT VS RISK CROSSTABULATION

WBC COUNT		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	56	26	0	82
	% within WBC.COUNT	68.3%	31.7%	0.0%	100.0%
Elevated	Count	1	13	4	18
	% within WBC.COUNT	5.6%	72.2%	22.2%	100.0%
Total	Count	57	39	4	100
	% within WBC.COUNT	57.0%	39.0%	4.0%	100.0%



Eight two (82%) patients had normal white blood cell count, out of the 82 patients, 56(68.3%) patients were identified as low risk for IAI and 26(31.7%) patients were identified as intermediate risk for IAI. Eighteen (18%) patients had elevated white blood cell count, out of the 18 patients, 1(5.6%) patient was identified as low risk for IAI, 13(72.2%) patients were identified as intermediate risk for IAI and 4(22.2%) patients as high risk for IAI (table 23).

Table 37:

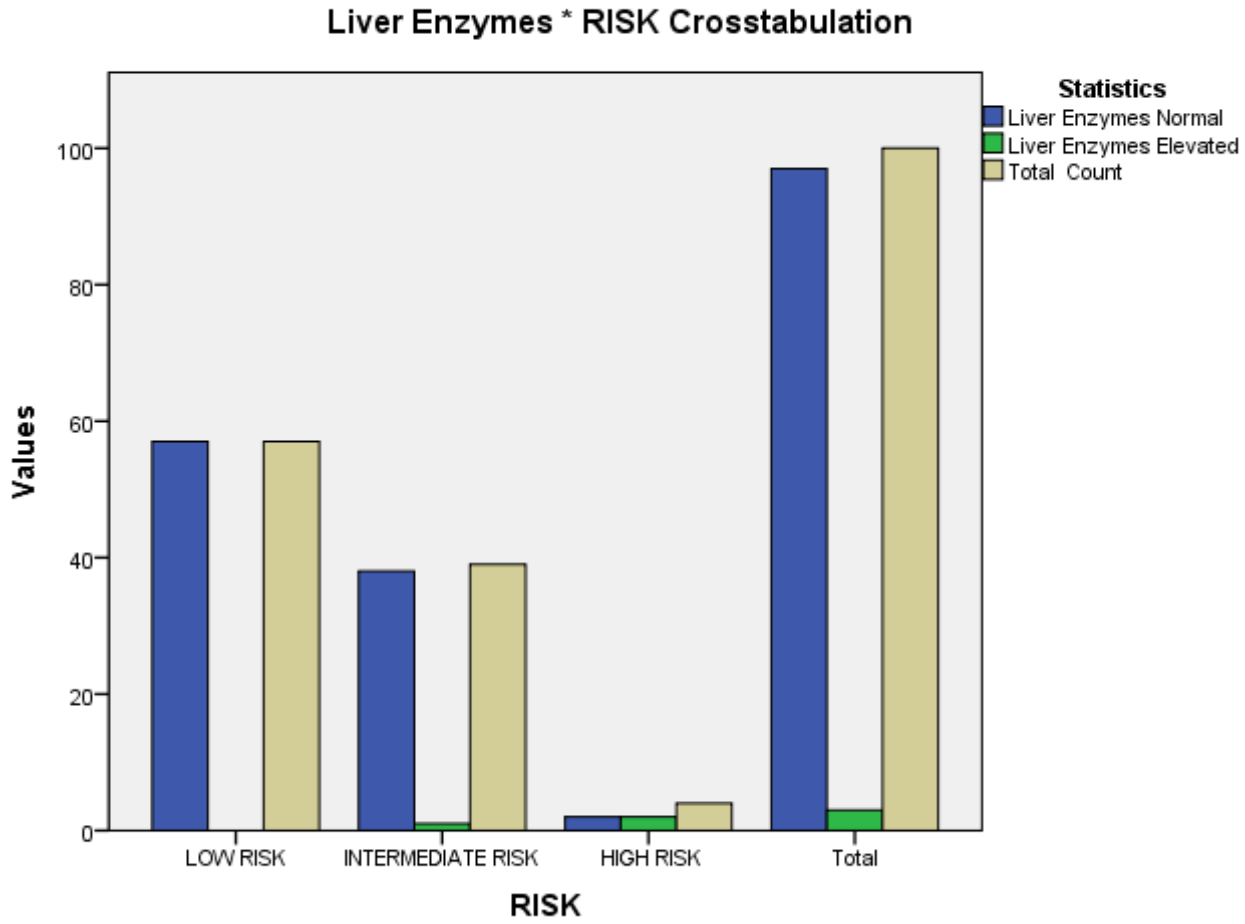
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.627	2	.002
Likelihood Ratio	34.562	2	.002
Linear-by-Linear Association	32.049	1	.002
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 34.627 and degree of freedom of 2, the p value obtained is 0.002 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between white blood cell count and risk of IAI, outcome & management of blunt injury abdomen.

Table 24: LIVER ENZYMES VS RISK CROSSTABULATION

Liver Enzymes		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Normal	Count	57	38	2	97
	% within Liver Enzymes	58.8%	39.2%	2.1%	100.0%
Elevated	Count	0	1	2	3
	% within Liver Enzymes	0.0%	33.3%	66.7%	100.0%
Total	Count	57	39	4	100
	% within Liver Enzymes	57.0%	39.0%	4.0%	100.0%



Ninety seven (97%) patients had normal values of liver enzymes, out of the 97 patients, 57(58.8%) patients were identified as low risk for IAI, 38(39.2%) patients were identified as intermediate risk for IAI and 2(2.1%) patients were identified as high risk for IAI. Three (3%) patients had elevated values of liver enzymes, out of the 3 patients, 1(33.3%) patients were identified as intermediate risk for IAI and 2(66.7%) patients as high risk for IAI (table 24).

Table 38:

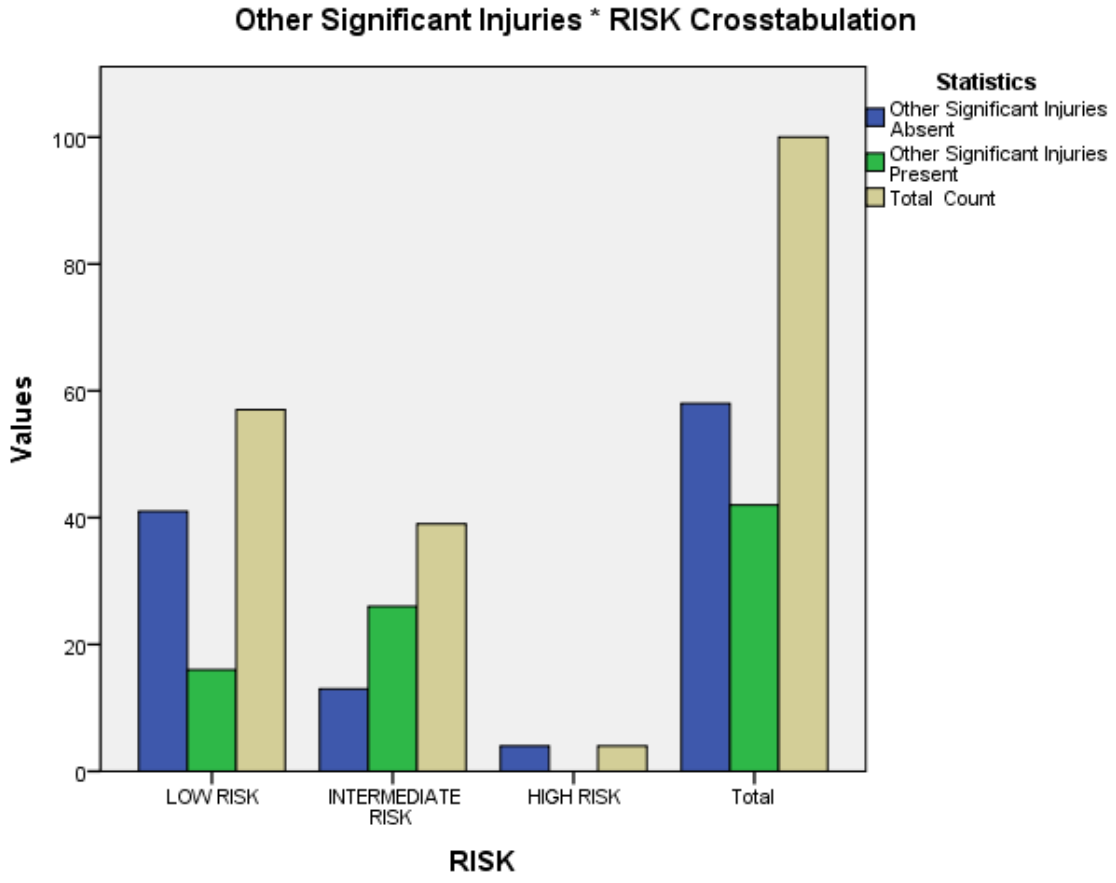
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.153	2	.001
Likelihood Ratio	12.102	2	.002
Linear-by-Linear Association	13.323	1	.001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 32.153 and degree of freedom of 2, the p value obtained is 0.001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between liver enzymes and risk of IAI, outcome & management of blunt injury abdomen.

Table 25:OTHER SIGNIFICANT INJURIES VS RISK CROSSTABULATION

Other Significant Injuries		RISK			Total
		LOW	INTERMEDIATE	HIGH	
Absent	Count	41	13	4	58
	% within Other Significant Injuries	70.7%	22.4%	6.9%	100.0%
Present	Count	16	26	0	42
	% within Other Significant Injuries	38.1%	61.9%	0.0%	100.0%
Total	Count	57	39	4	100
	% within Other Significant Injuries	57.0%	39.0%	4.0%	100.0%



Fifty Eight (58%) patients had no other significant injuries, out of the 58 patients, 41(70.7%) patients were identified as low risk for IAI, 13(22.4%) patients were identified as intermediate risk for IAI and 4(6.9%) patients were identified as high risk for IAI. Forty two (42%) patients had other significant injuries, out of the 42 patients, 16(38.1%) patients were identified as low risk for IAI and 26(61.9%) patients as intermediate risk for IAI (table 25).

Table 39:

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.178	2	.001
Likelihood Ratio	18.738	2	.001
Linear-by-Linear Association	4.839	1	.028
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 17.178 and degree of freedom of 2, the p value obtained is 0.001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between other significant injuries and risk of IAI, outcome & management of blunt injury abdomen.

Table 40: Inter-study comparison of parameters and their p value

Parameters	Shojaee et al (2014)	Present study
Abdominal pain	<0.0001	0.071
Pulse rate	<0.0001	0.0001
Systolic BP	0.003	0.0001
Peritonitis	<0.0001	0.01
Free fluid	0.003	0.0001
Imaging	<0.0001	0.0001
Other significant injuries	0.01	0.01

Comparing the p values of common parameters in both studies, except for abdominal pain all other parameters are statistically significant and comparable to the study by Shojaee et al (table 40).

Table 41: outcome/ management Vs Risk cross tabulation

		RISK			Total
		LOW	INTERMEDIATE	HIGH	
outcome	**Discharged**	57(75)	19(25)	0(0)	76(100)
	Observation	0(0)	20(100)	0(0)	20(100)
	Laparotomy	0(0)	0(0)	4(100)	4(100)
Total		57(57)	39(39)	4(4)	100(100)

*Figures in parenthesis indicates percentages

76 patients were discharged after initial evaluation without admission and observation, out of the 76 patients, 57(75%) patients were identified as low risk for IAI and had scores <14 and; 19(25%) patients were identified as intermediate risk for IAI and had scores between 14 to 18. 20 patients required admission and observation and all of them were identified as intermediate risk for IAI and had scores between 14 to 18. 4 patients required laparotomy and all of them were identified as high risk for IAI and had scores ≥18.

Table 42: Statistical significance of score

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	194.258	20	.0001
Likelihood Ratio	125.141	20	.0001
Linear-by-Linear Association	72.235	1	.0001
N of Valid Cases	100		

According to Pearson Chi Square test, with a value of 194.258 and degree of freedom of 20, the p value obtained is 0.0001 which is <0.05 and hence is significant.

Hence there is a definite statistical correlation between the score and risk of IAI, outcome & management of blunt injury abdomen.

Since there is definite statistical significance of the score, conclusion of this study is,

- Scores <14 – low risk for IAI and can be discharged after initial evaluation
- Scores between 14-18 – intermediate risk for IAI and need admission and observation
- Scores ≥ 18 – high risk for IAI and need laparotomy

SUMMARY

This prospective observational study was conducted in institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, from February 2015 to August 2015. The study was conducted on 100 randomly selected patients with blunt injury abdomen and satisfying the inclusion criteria. Age of 100 patients ranged from 20 to 72 years. Most of the patients (29%) were between 20-29 years. The male to female ratio was 4.5: 1. So, males were the predominantly involved group. The most common mode of injury was Road traffic accident (RTA) which accounted for 67% of blunt injury abdomen. All the 100 patients were evaluated using the 30-point blunt abdominal injury scoring system based on 10 important parameters. Based upon the above scoring system and outcome the patients were divided into three groups – low risk, intermediate risk and high risk. Scores of 14 and 18 were considered the cut-off points. Patient with a score less than 14 were identified as low risk for intra-abdominal injury (IAI). Scores of greater than/equal to 18 were identified as high risk for IAI. Scores between 14 and18 were identified as intermediate risk for IAI. Predominantly most blunt injury abdomen patients in the study were identified as low risk for IAI (score < 14), accounting for 57% of study patients. Out of the 100 patients with blunt injury abdomen in our study, only thirteen (13%) patients had Intra-abdominal injury (IAI). Though blunt injury abdomen is a common entity in our trauma wards,

the prevalence of Intra-abdominal injury is low. Patients in the age group of 30-39 years with blunt injury abdomen were found to be more at risk for Intra-abdominal injury. As far as gender prevalence of intra-abdominal injury (IAI) in blunt injury abdomen in this study is considered, males are more at risk compared to females. Out of the 10 parameters in the scoring system, except for abdominal pain all other parameters were statistically significant (p value <0.05). 76 patients were discharged after initial evaluation without admission and observation, out of the 76 patients, 57(75%) patients were identified as low risk for IAI and had scores <14 and; 19(25%) patients were identified as intermediate risk for IAI and had scores between 14 to 18. 20 patients required admission and observation and all of them were identified as intermediate risk for IAI and had scores between 14 to 18. 4 patients required laparotomy and all of them were identified as high risk for IAI and had scores ≥18. According to Pearson Chi Square test, the p value obtained is 0.0001 which is <0.05 and hence is significant. Hence there is a definite statistical correlation between the score and risk of IAI, outcome & management of blunt injury abdomen. Since there is definite statistical significance of the score, conclusion of this study is, Scores <14 – low risk for IAI and can be discharged after initial evaluation, Scores between 14-18 – intermediate risk for IAI and need admission and observation, Scores ≥ 18 – high risk for IAI and need laparotomy.

CONCLUSION

This prospective observational study was conducted in institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, from February 2015 to August 2015. It can be concluded from the findings of the study that blunt injury abdomen is a common entity in our trauma wards. Males are more prone for blunt injury abdomen and for intra-abdominal injury (IAI). Most common age group was 20-29 years. Road Traffic Accidents were the most common mode of injury. Though blunt injury abdomen is common, the prevalence of Intra-abdominal injury is low. Out of the 10 parameters in the scoring system, except for abdominal pain all other parameters were statistically significant. According to Pearson Chi Square test, there is a definite statistical correlation between the score and risk of IAI, outcome & management of blunt injury abdomen. Since there is definite statistical significance of the score, conclusion of this study is,

- Scores <14 – low risk for IAI and can be discharged after initial evaluation
- Scores between 14-18 – intermediate risk for IAI and need admission and observation
- Scores ≥ 18 – high risk for IAI and need laparotomy.

Hence using this score we can detect intra-abdominal injury with reasonable accuracy and decide on the management of blunt injury abdomen, which will reduce the mortality and morbidity in patients with blunt injury abdomen.

LIMITATIONS OF THE STUDY

As this study has been carried out over a limited period of time with limited number of patients and there was lack of financial and infrastructural support, the study results are enough to be of reasonable precision**.** Since the study population and area were restricted only to a single tertiary level hospital, the significance of this score in other populations is yet to be studied. All of the facts and figures mentioned here may considerably vary from those of large series covering wide range of time, but still then, as the cases of this study were collected from a tertiary level hospital in our country, this study has some credentials in reflecting the factors/parameters involved in blunt injury abdomen and their correlation with the outcome and management of the blunt injury abdomen.

RECOMMENDATIONS

- The Preliminary investigations mentioned in the study, most importantly imaging investigations(ultrasound abdomen and computed tomography) should be made available in all trauma centres
- Inclusion of score/scoring system as a part of initial evaluation of blunt injury abdomen will aid in early identification, proper management and reduce morbidity and mortality in blunt injury abdomen.
- Meticulous and precise evaluation is always necessary in cases of blunt injury abdomen for early detection of intra-abdominal injury(IAI)
- Score/Scoring systems are easy to learn and comprehend and can be used by all medical personnel
- Further research is necessary in a large scale regarding application/credibility of this score in other populations and demography, so as to develop a universal scoring system for management of blunt injury abdomen which will be applicable worldwide.

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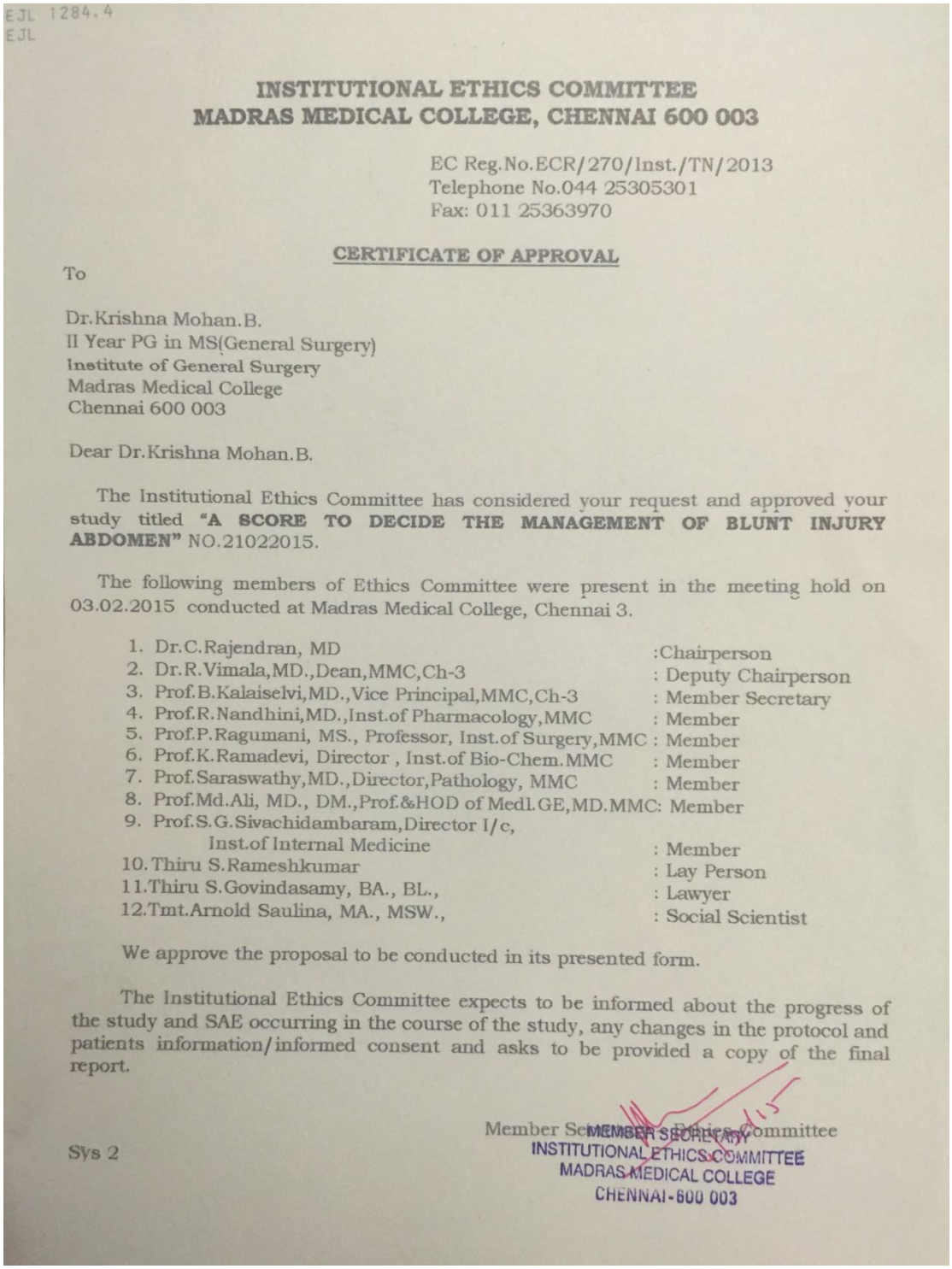
APPENDIX – I: ETHICAL COMMITTEE CLEARENCE



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INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To

Dr.Krishna Mohan.B.
II Year PG in MS(General Surgery)
Institute of General Surgery
Madras Medical College
Chennai 600 003

Dear Dr.Krishna Mohan.B.

The Institutional Ethics Committee has considered your request and approved your study titled **"A SCORE TO DECIDE THE MANAGEMENT OF BLUNT INJURY ABDOMEN"** NO.21022015.

The following members of Ethics Committee were present in the meeting hold on 03.02.2015 conducted at Madras Medical College, Chennai 3.

1. Dr.C.Rajendran, MD	:Chairperson
2. Dr.R.Vimala,MD.,Dean,MMC,Ch-3	: Deputy Chairperson
3. Prof.B.Kalaiselvi,MD.,Vice Principal,MMC,Ch-3	: Member Secretary
4. Prof.R.Nandhini,MD.,Inst.of Pharmacology,MMC	: Member
5. Prof.P.Ragumani, MS., Professor, Inst.of Surgery,MMC	: Member
6. Prof.K.Ramadevi, Director , Inst.of Bio-Chem.MMC	: Member
7. Prof.Saraswathy,MD.,Director,Pathology, MMC	: Member
8. Prof.Md.Ali, MD., DM.,Prof.&HOD of Medl.GE,MD.MMC	: Member
9. Prof.S.G.Sivachidambaram,Director I/c, Inst.of Internal Medicine	: Member
10. Thiru S.Rameshkumar	: Lay Person
11.Thiru S.Govindasamy, BA., BL.,	: Lawyer
12.Tmt.Arnold Saulina, MA., MSW.,	: Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

Sys 2

APPENDIX – II: DATA COLLECTION SHEET

PATIENT PROFORMA

PATIENT DETAILS:

Name: Age: Sex:

IP.No.:

D.O.A :

ON ADMISSION:

Presenting Complaints:

Mode of injury:

Symptoms:

Co – Morbid Illness:

Significant Past History:

CLINICAL EXAMINATION:

Pulse:	BP:
RR:	Temp:
Pallor:	Icterus:
CVS:	RS:
P/A:	GCS:

INVESTIGATIONS:

WBC Count:

Renal Function Test:

Liver Function Test:

Blood Grouping:

ECG:

CXR:

USG Abdomen:

CT Abdomen:

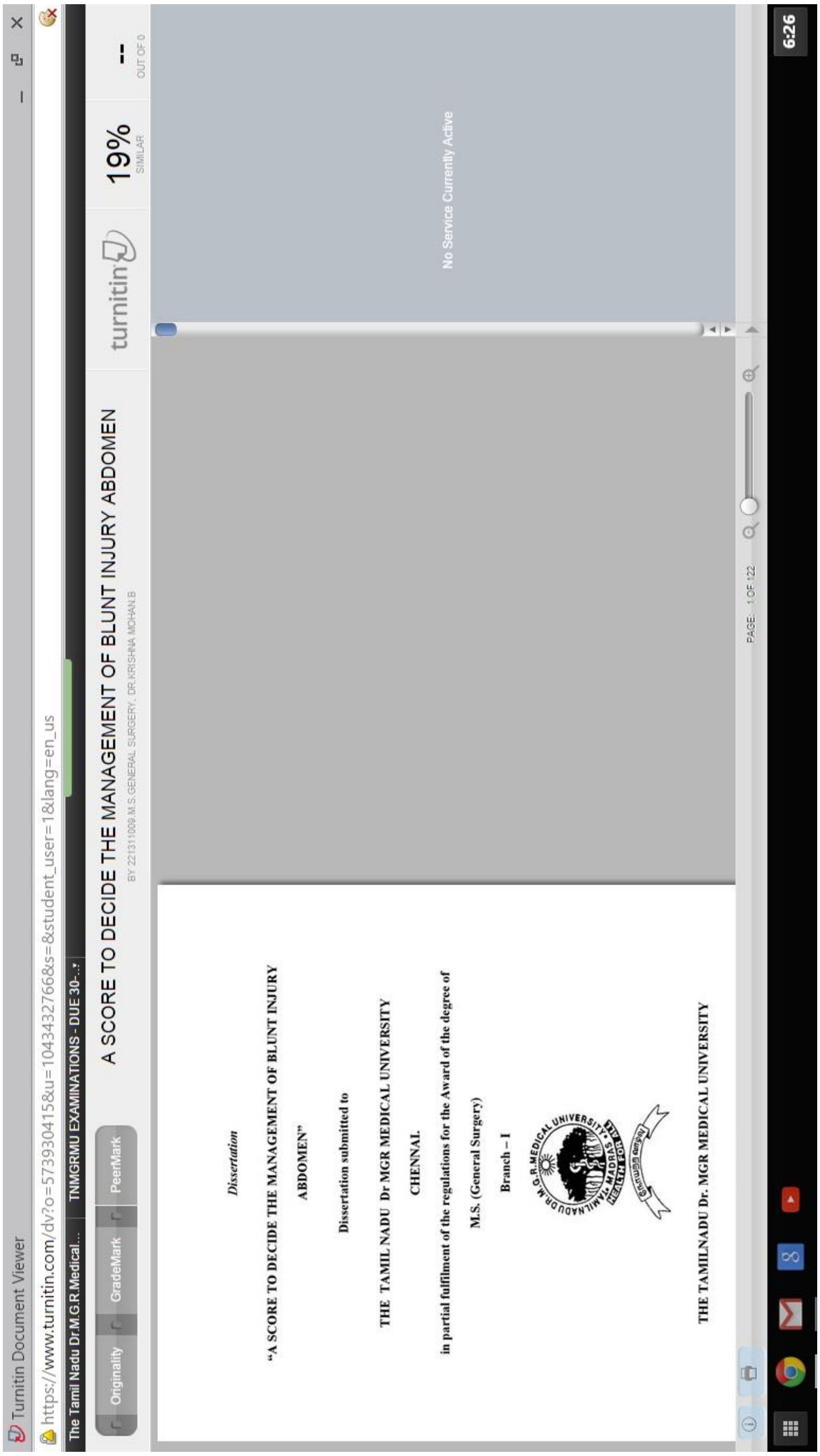
Score table:

Parameters	Points/Score
Abdominal pain Absent - 1 point Present- 2 points	
Pulse rate <90 /min – 1 point 90-110 /min – 2 points >110 /min – 3 points	
Systolic blood pressure >120 mmHg - 1 point 90-120 mmHg -2 points <90 mmHg – 3 points	
Peritonitis Absent – 1 point Present – 4 points	
Free fluid Absent – 1 point Present – 4 points	
Imaging Normal – 1 point Free fluid – 2 points Solid organ injury – 3 points	

Serum creatinine < 1.4 mg/dl– 1 point >1.4 mg/dl – 3 points	
White blood cell count < 10,000 cells/cu.mm – 1 point >10,000 cells/cu.mm – 2 points	
Liver enzymes(AST/ALT) Normal – 1 point Elevated – 3 points	
Other significant injuries absent – 1 point present – 3 points	
TOTAL SCORE	

Outcome: Discharged/Observation/Laparotomy

APPENDIX – III: PLAGIARISM



APPENDIX – IV: MASTER CHART

S.NO	NAME	IP NO	AGE	SEX	ABDOMINAL PAIN	HAEMODYNAMIC STABILITY		PERITONITIS	FREE FLUID	IMAGING	SERUM CREATININE	WBC COUNT	LIVER ENZYMES	OTHER SIGNIFICANT INJURIES	TOTAL SCORE	MODE OF INJURY	OUTCOME
						PULSE RATE	BP										
1	ASHRAF	105687	40	M	2	1	2	1	1	1	1	1	1	1	12	RTA	DISCHARGED
2	SUGU	105773	24	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
3	SUBRAMANI	105834	50	M	2	1	1	1	1	1	1	1	1	3	13	FALL FROM HEIGHT	DISCHARGED
4	VENKATESH	107331	21	M	2	1	1	1	1	1	1	1	1	1	11	ASSAULT	DISCHARGED
5	KANNAN	107524	48	M	2	1	2	1	4	2	1	2	1	1	17	RTA	OBSERVATION
6	BALAKRISHNAN	107569	52	M	1	1	1	1	1	1	1	1	1	3	13	RTA	DISCHARGED
7	RAMAN	107615	53	M	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
8	ELUMALAI	107631	21	M	2	1	2	1	1	1	1	1	1	1	12	RTA	DISCHARGED
9	RAVANAIAH	110400	55	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
10	KALYANA SUNDARAM	110436	50	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
11	SRIPRIYA	110474	61	M	1	1	1	1	1	1	1	1	1	3	12	FALL FROM HEIGHT	DISCHARGED
12	MEGANATHAN	110488	40	M	2	3	3	4	4	2	1	2	1	1	23	RTA	LAPAROTOMY
13	ARUMUGHAM	110509	42	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
14	MANOGARAN	112713	51	M	1	1	2	1	1	1	1	1	1	3	13	RTA	DISCHARGED
15	RUBESH	112968	40	M	1	1	3	1	1	1	1	1	1	3	14	RTA	DISCHARGED
16	GOPALAN	112968	40	M	1	1	3	1	1	1	1	1	1	3	14	RTA	DISCHARGED
17	PRABHA	113114	32	F	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
18	RAMALINGAM	115428	65	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
19	FARDEEN	115677	30	M	1	1	1	1	1	1	1	1	1	1	10	FALL FROM HEIGHT	DISCHARGED
20	JAYAPRAKASH	115705	24	M	1	1	2	1	1	1	1	1	1	3	13	RTA	DISCHARGED
21	KANNAN	115705	45	M	2	2	2	1	1	2	1	2	1	1	15	RTA	OBSERVATION
22	NAARAYANAN	115705	50	M	1	2	2	1	1	1	1	1	1	3	14	RTA	DISCHARGED
23	MURALIKRISHNAN	115739	35	M	2	3	3	1	4	2	1	2	3	1	22	ASSAULT	LAPAROTOMY
24	SUSEELA	118253	56	F	2	1	1	1	1	1	1	1	1	1	11	ASSAULT	DISCHARGED
25	SURESH	118285	39	M	2	2	1	1	1	1	1	1	1	1	12	ASSAULT	DISCHARGED
26	MADHAVAN	120869	60	M	2	1	1	1	1	1	1	1	1	3	13	RTA	DISCHARGED
27	ARUN	121100	62	M	2	3	2	1	1	2	1	2	1	1	16	RTA	OBSERVATION
28	JAMUNA	121158	43	F	2	2	2	1	1	1	1	1	1	1	13	OTHERS	DISCHARGED
29	RAJAMANIKAM	121201	55	M	1	2	2	1	1	1	1	1	1	3	14	RTA	DISCHARGED
30	DIVYA	121206	21	F	1	1	1	1	1	1	1	2	1	3	13	RTA	DISCHARGED
31	JAFFUR	121300	43	M	2	2	1	1	1	1	1	1	1	1	12	RTA	DISCHARGED
32	NACHIAPPAN	123178	70	M	1	1	3	1	1	1	1	1	1	3	14	OTHERS	DISCHARGED
33	KAMALA	123190	60	F	2	2	1	1	1	1	1	2	1	3	15	RTA	OBSERVATION
34	MUNIAPPAN	123261	47	M	1	2	2	1	1	1	1	1	1	3	14	RTA	DISCHARGED
35	GANGADARAN	123271	33	M	1	2	3	1	1	1	1	1	1	3	15	RTA	OBSERVATION
36	RAMAN	123331	45	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
37	PEER HANEEF	126818	21	M	2	2	2	1	1	1	1	1	1	1	13	ASSAULT	DISCHARGED
38	DARBAR BASHA	129178	24	M	1	1	3	1	1	1	1	2	1	3	15	RTA	OBSERVATION
39	VENKATESAN	126930	28	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
40	LAKSHMI	129178	69	F	2	1	1	1	1	1	1	1	1	3	13	RTA	DISCHARGED
41	PRAKASH	129396	36	M	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
42	PON KARTHIKEYAN	129372	38	M	1	1	1	1	1	1	1	1	1	1	10	ASSAULT	DISCHARGED
43	VIJAY VIKRAM	129456	25	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
44	VELAYUTHAM	129470	72	M	1	1	2	1	1	1	1	1	1	1	11	FALL FROM HEIGHT	DISCHARGED
45	THANGARAJ	131400	21	M	1	3	1	1	1	1	1	1	1	3	14	RTA	DISCHARGED
46	SEKAR	131431	27	M	1	1	1	1	1	1	1	1	1	3	12	FALL FROM HEIGHT	DISCHARGED
47	RAJ	131609	20	M	1	1	3	1	1	1	1	1	1	3	14	TTA	DISCHARGED
48	MAHESH BABU	131609	20	M	2	3	3	1	4	3	1	2	3	1	23	RTA	LAPAROTOMY
49	DANIEL FRANCIS	131615	45	M	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
50	VENUGOPAL	131646	64	M	1	1	1	1	1	1	1	1	1	1	10	OTHERS	DISCHARGED

S.NO	NAME	IP NO	AGE	SEX	ABDOMINAL PAIN	HAEMODYNAMIC STABILITY		PERITONITIS	FREE FLUID	IMAGING	SERUM CREATININE	WBC COUNT	LIVER ENZYMES	OTHER SIGNIFICANT INJURIES	TOTAL SCORE	MODE OF INJURY	OUTCOME
						PULSE RATE	BP										
51	KUMAR	131655	60	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
52	KATHIRAVAN	131663	25	M	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
53	RAJALAKSHMI	131679	45	F	1	2	2	1	1	1	1	1	1	3	14	RTA	DISCHARGED
54	ALEX	170	21	M	2	3	1	1	1	1	1	1	1	1	13	RTA	DISCHARGED
55	LAKSHMANAN	189	26	M	2	2	2	1	1	2	1	1	1	3	16	RTA	OBSERVATION
56	JAYALAKSHMI	232	22	F	2	1	1	1	1	1	1	1	1	1	11	ASSAULT	DISCHARGED
57	AMEER	250	42	M	2	2	1	1	1	1	1	1	1	1	12	RTA	DISCHARGED
58	MADHAN KUMAR	251	26	M	1	2	2	1	1	1	1	1	1	3	14	ASSAULT	DISCHARGED
59	PALAVESAN	281	23	M	1	1	2	1	1	1	1	1	1	1	11	RTA	DISCHARGED
60	KANNAN	309	30	M	2	1	2	1	1	1	1	2	1	3	15	RTA	OBSERVATION
61	KUMAR	3123	40	M	1	1	1	1	1	1	1	1	1	3	12	RTA	DISCHARGED
62	RAVICHANDRAN	3169	28	M	2	2	2	1	1	1	1	1	1	3	15	FALL FROM HEIGHT	OBSERVATION
63	BALAJI	3189	51	M	2	3	2	1	1	2	1	2	1	1	16	RTA	OBSERVATION
64	VELU	3190	50	M	2	2	2	1	1	2	3	1	1	1	16	RTA	OBSERVATION
65	SAKTHIVEL	3196	71	M	1	2	2	1	1	1	1	1	1	3	14	RTA	DISCHARGED
66	DURGA PRASAD	4970	42	M	2	1	1	1	1	1	1	1	1	1	11	OTHERS	DISCHARGED
67	SRINIVASAN	5002	55	M	1	3	1	1	1	1	1	1	1	1	12	RTA	DISCHARGED
68	RAVINDRA KUMAR	5040	47	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
69	PRABHAKARAN	5042	53	M	2	1	1	1	1	1	1	1	1	1	11	FALL FROM HEIGHT	DISCHARGED
70	NAGASAMY	5057	30	M	2	2	2	1	1	1	1	1	1	1	13	OTHERS	DISCHARGED
71	NATARAJAN	5075	26	M	1	1	1	1	1	1	1	1	1	1	10	ASSAULT	DISCHARGED
72	RAMESH	5079	25	M	2	2	1	1	1	1	3	1	1	3	16	RTA	OBSERVATION
73	KUMARI	5108	28	F	2	1	1	1	1	1	1	1	1	3	13	RTA	DISCHARGED
74	BALAJI	7412	33	M	2	2	1	1	1	1	1	1	1	3	14	RTA	DISCHARGED
75	SANDHYA	7727	25	F	2	2	2	1	1	1	1	2	1	1	14	RTA	DISCHARGED
76	THIRUNAVUKARASU	7754	51	M	1	1	3	1	1	1	1	1	1	3	14	RTA	DISCHARGED
77	BABU	7790	45	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
78	EDWARD	10289	38	M	2	3	2	1	1	1	1	1	1	1	14	FALL FROM HEIGHT	DISCHARGED
79	CHANDRASEKAR	10369	63	M	2	2	2	1	1	1	1	1	1	3	15	RTA	OBSERVATION
80	JAYA MOORTHI	10370	33	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
81	MASILA MANI	13018	30	M	2	1	1	1	1	1	1	1	1	1	11	ASSAULT	DISCHARGED
82	SARASWATHI	13042	32	F	1	1	1	1	1	1	1	1	1	1	10	OTHERS	DISCHARGED
83	ARUNAGIRI	13063	43	M	1	1	3	1	1	1	1	2	1	3	15	RTA	OBSERVATION
84	CHELLADURAI	13081	60	M	2	1	1	1	1	1	1	1	1	1	11	RTA	DISCHARGED
85	SRINIVASAN	13127	30	M	1	1	1	1	1	1	1	1	1	1	10	RTA	DISCHARGED
86	ANAND	15570	23	M	2	3	1	1	1	1	1	2	1	3	16	RTA	OBSERVATION
87	RATAN	21403	30	M	2	3	2	1	1	1	3	2	1	1	17	RTA	OBSERVATION
88	FATHIMA BEEVI	23822	30	F	2	3	1	1	1	1	1	1	1	1	13	ASSAULT	DISCHARGED
89	VIJAYA	26761	55	F	2	3	1	1	1	1	1	1	1	3	15	FALL FROM HEIGHT	OBSERVATION
90	BALAKANNAN	34551	20	M	2	3	2	1	1	2	1	1	1	1	15	RTA	OBSERVATION
91	MANIKANDAN	34700	39	M	2	1	1	1	1	1	1	1	1	1	11	OTHERS	DISCHARGED
92	SHANMUGHAM	39904	42	M	2	2	2	1	1	2	1	1	3	1	16	FALL FROM HEIGHT	OBSERVATION
93	MURUGAN	39937	37	M	2	3	3	4	4	3	1	2	1	1	24	OTHERS	LAPAROTOMY
94	VERAMANI	42564	27	F	2	2	2	1	1	1	1	1	1	3	15	RTA	OBSERVATION
95	MOHAMMED MUSTHAFA	45282	45	M	2	3	1	1	1	1	1	1	1	1	13	RTA	DISCHARGED
96	JAYAKUMAR	47862	46	M	2	2	2	1	1	1	1	2	1	1	14	OTHERS	DISCHARGED
97	SUMATHY	48057	35	F	1	1	1	1	1	1	1	1	1	1	10	FALL FROM HEIGHT	DISCHARGED
98	SESHAMMA	50849	42	F	2	3	2	1	1	1	3	2	1	1	17	RTA	OBSERVATION
99	PACHYAMMAL	62000	20	F	2	1	2	1	1	1	1	1	1	3	14	ASSAULT	DISCHARGED
100	SAHA DEVARAJ	64784	60	M	2	3	1	1	1	2	1	1	1	1	14	RTA	DISCHARGED

APPENDIX – V: ABBREVIATIONS

IAI- Intra-abdominal injury

USG- Ultrasound

CT- Computed Tomography

MRI- Magnetic Resonance Imaging

ED- Emergency Department

ICU- Intensive Care Unit

OPD – Out Patient Department

OT- Operation Theatre

RTA- Road Traffic Accident

ALT- Alanine Transaminase

AST- Aspartate Transaminase

GCS- Glasgow Coma Scale